Rubber Journal and International Plastics

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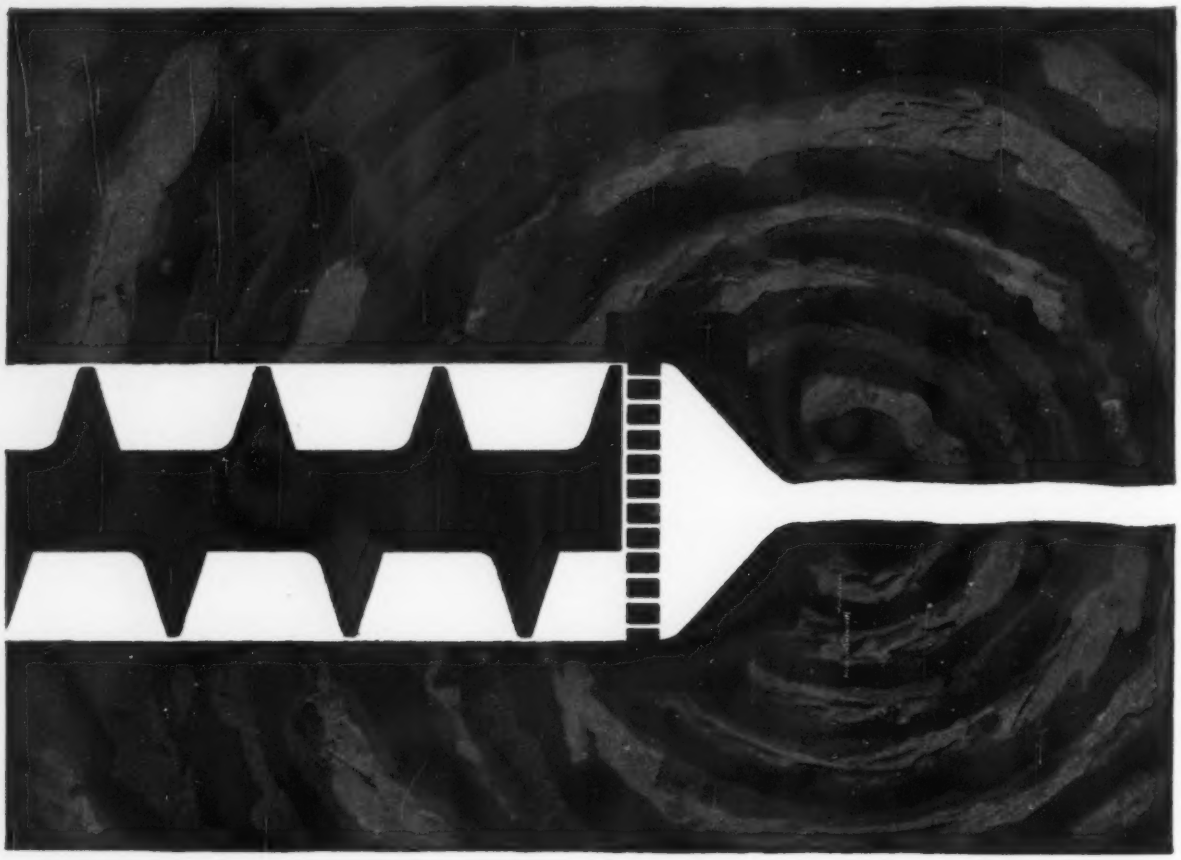

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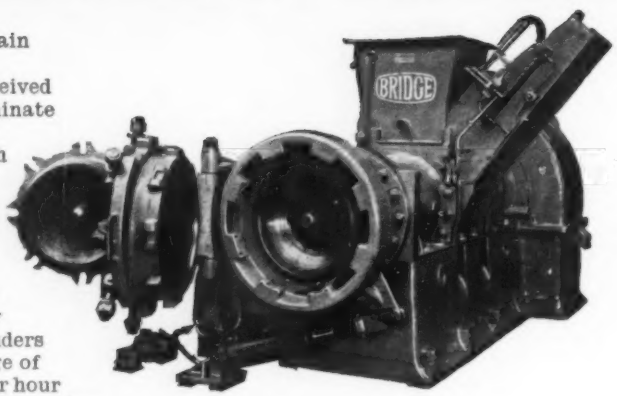

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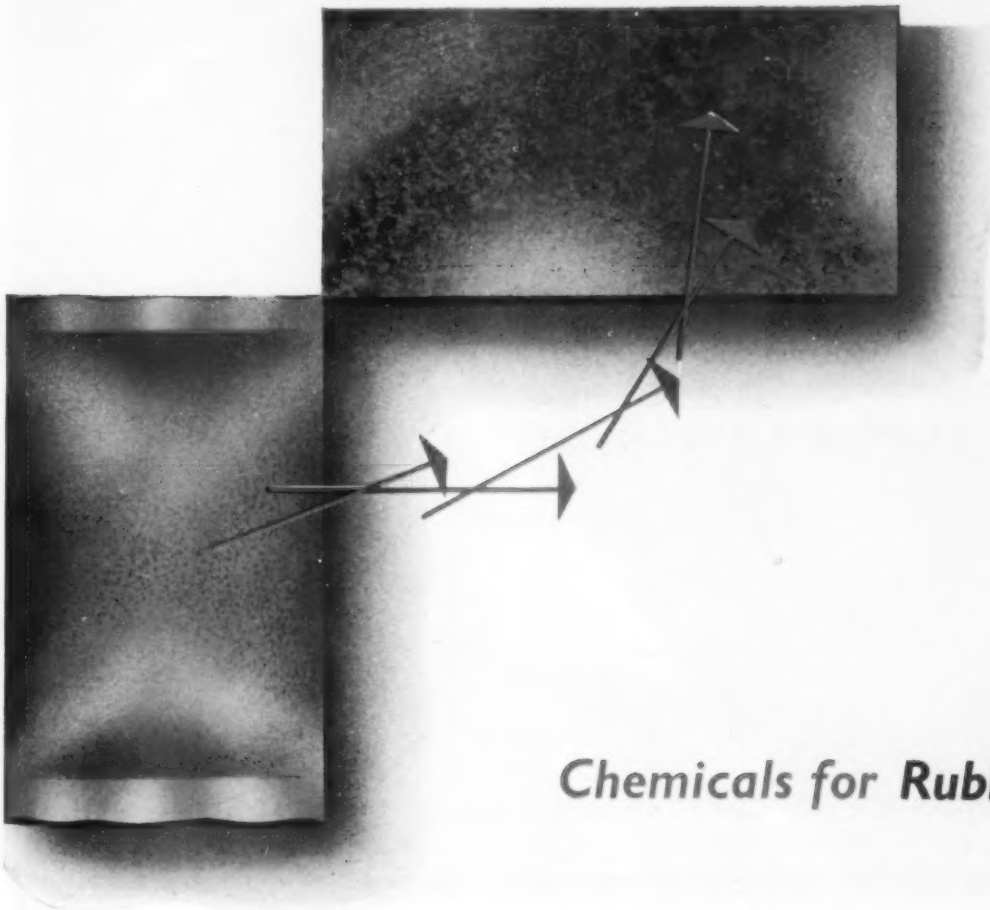

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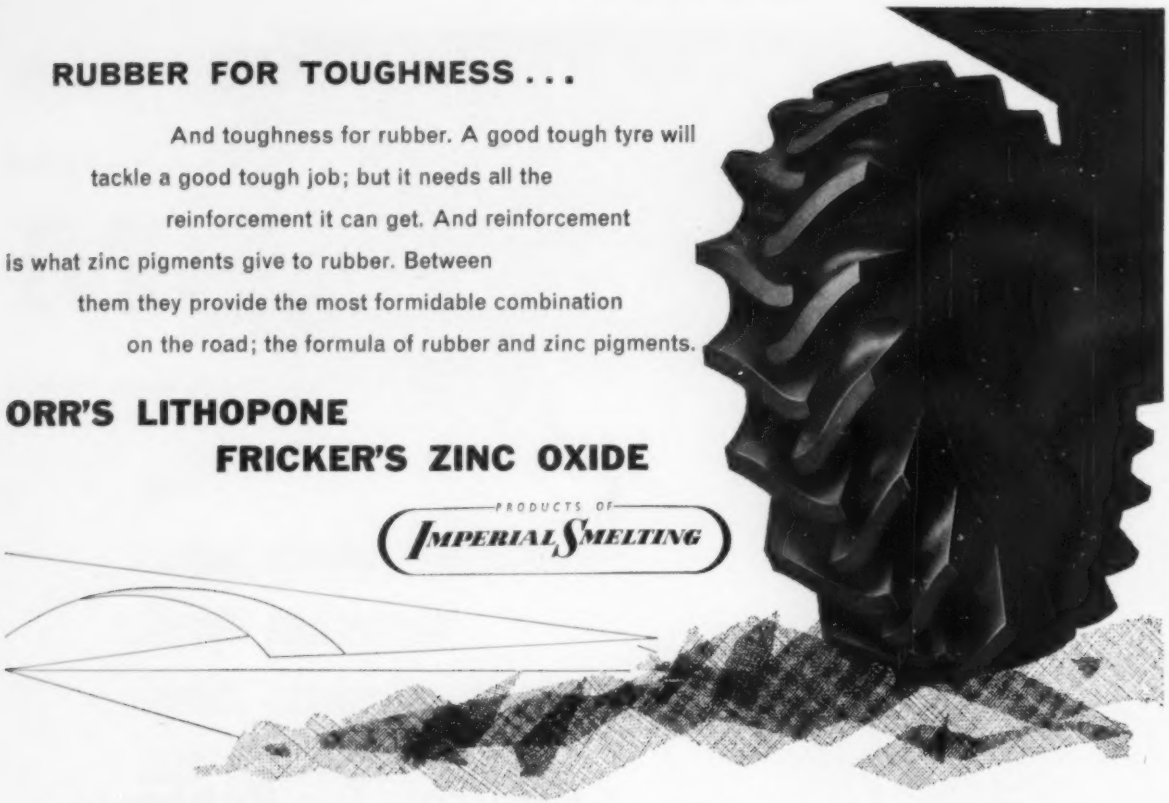

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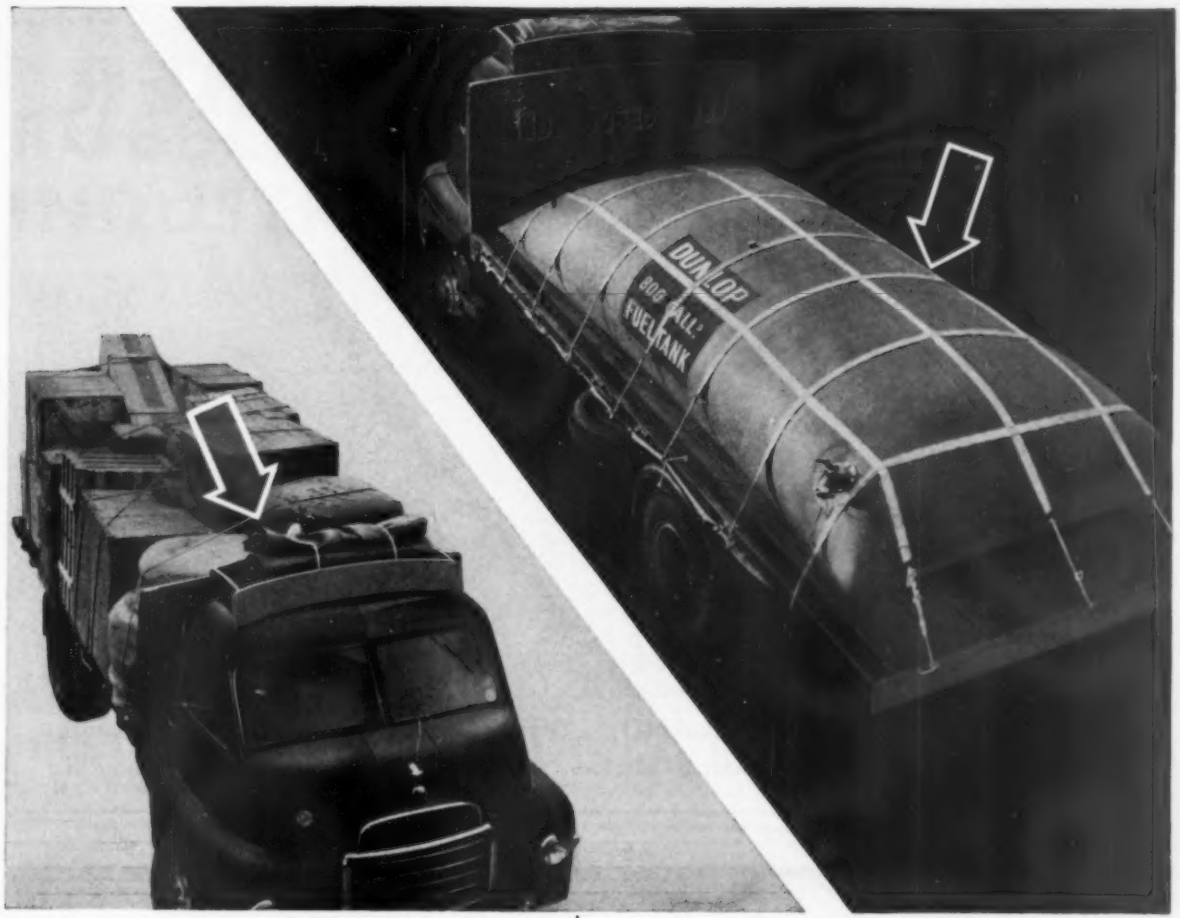

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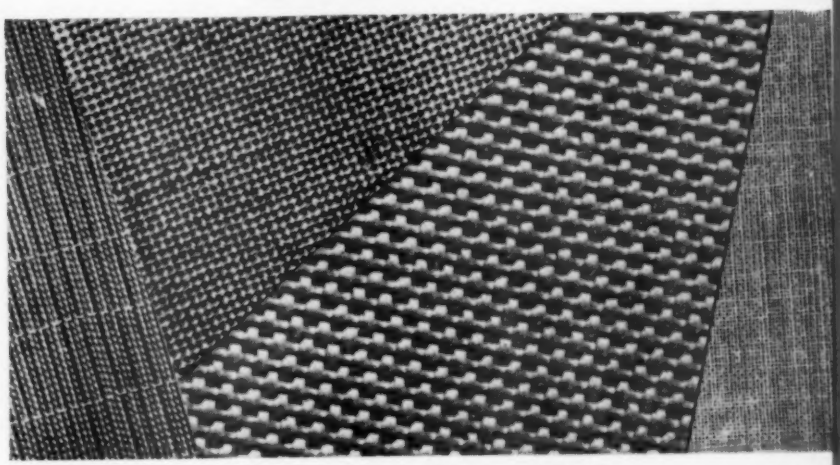

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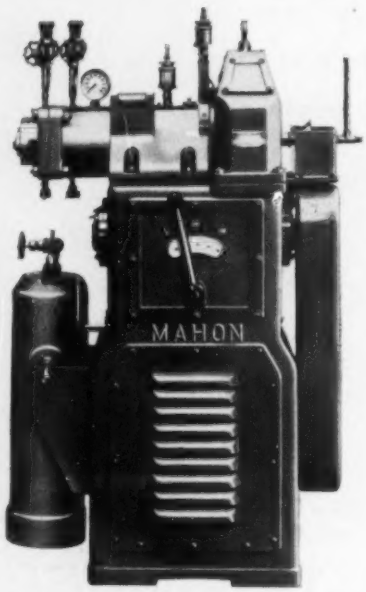

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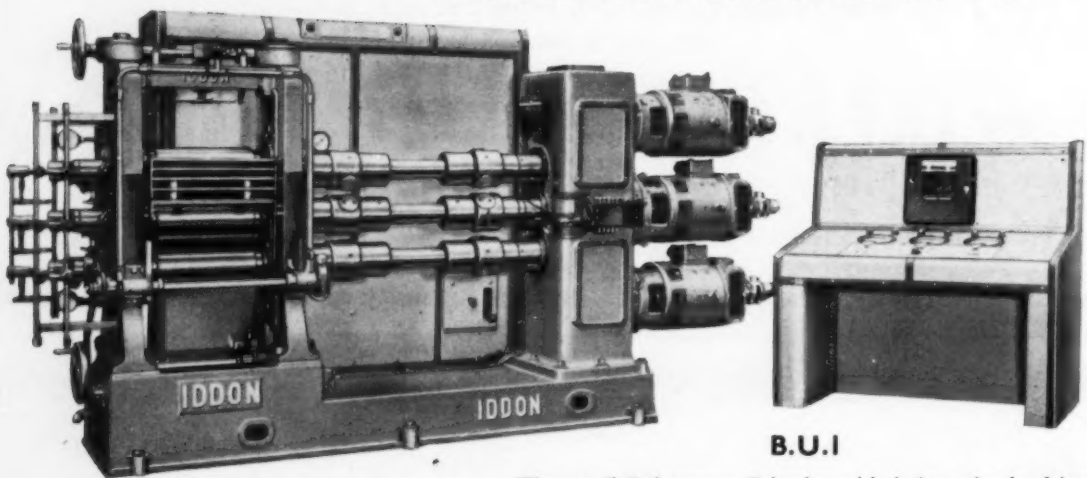

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IN ITS 76th YEAR

June 18 1960

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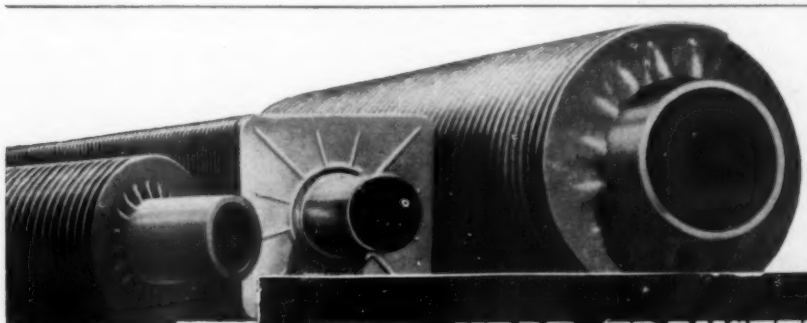

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NOTES of the WEEK

Electricity Supply

INCREASINGLY, and certainly so in rubber and plastics, industry is dependent upon electricity. The growth of electricity demand, averaging 7% per annum cumulative over the last 30 years, generation methods and operational trends were subjects of a number of papers at the recent British Electrical Power Convention. An extremely interesting paper was that on electricity supply by Mr C. R. King, chairman of the Electricity Council. Looking to the future, and referring to nuclear power stations, Mr King said that because of the relatively high capital costs, it would be necessary to run these at load factors of about 75%. This, he said, stressed the need for the development of energy storage facilities, for absorbing as much as possible of their off-peak output.

Although there were many possibilities it seemed, said Mr King, that the only practicable large-scale method today would be by pumped storage hydro-plant. A 300MW plant of this kind is now being built in North Wales for operation next year. He went on to say that according to estimates the total potential in England, Wales and Southern Scotland for this method was not more than 2,000MW (for comparison, peak demand, on January 14 last, was 23,089MW against an available 23,505MW at the time).

Other Methods

A LONGER term prospect, went on Mr King, would be chemical energy storage through, for example, the fuel cell. Much had been accomplished in developing the hydrogen-oxygen fuel cell, which had an efficiency of the order of 60-70%. Off-peak power from the generating stations could be applied to the electrolysis of water to produce the hydrogen and oxygen required for use in these cells. A further possibility was by storage by compressed air, whereby air would be compressed by motor-driven compressors and delivered to steel pressure vessels or even possibly to underground caverns for storage. Energy stored in this way could be recovered as electricity by utilizing the air as a supply to a gas turbine using oil fuel. Similar concepts could be based on hot water storage or the use of liquified methane to supply a gaseous fuel to a gas turbine. Further developments of conventional type storage batteries should also be kept in mind. There was a great potential for the battery-driven road vehicle and the battery-driven railcar for short distances.

Mr King also gave some interesting figures on manpower. On an average, the manpower engaged in operating steam power stations was approximately 1.5 employees per 1,000 kW sent-out capacity. Conventional stations due to come into operation during the next two or three years would have figures as low as 0.3 to 0.4. This reduction reflected the greater use of instrumentation and control equipment, now an important design feature of modern stations. Automization of generating plant operation was now almost a theoretical possibility, said Mr King, and much work was being done to make it a practical possibility. The Board's approach is first to achieve fully remote control (at West Thurrock, due in commission in 1961) and, if this is successful, to employ a computer to control the operation.

Mouldy Motoneurones

A SENTENCE has been recently pointed out to us as the ultimate in technical jargon. It occurs in a broadsheet publicizing the Royal Society's Ferrier Lecture. The broadsheet refers to a type of inhibition in the central nervous system and goes on: ' . . . It is effected by the depolarization which group I muscle afferent volleys produce in the muscle afferent fibres monosynaptically exciting motoneurones . . .'

Every day we can pick out sentences from material which comes into these offices which, if not as bad as this, need reading several times before any sense can be made of them. If we ordered our groceries in the same way as many scientists write their papers, heaven knows what would arrive on the doorstep—if anything. It is almost as if many scientists feel duty bound to keep an obscure subject obscure when they write about it. But, if the standard of scientific writing is deplorably low, this is only part of a general phenomenon. The business world has its own jargon; teenagers their own secret language. Afferent volleys and excited motoneurones have parallels in ults and insts, in beatniks and mouldy figs. In fact, our idea of chaos would be to lock up in a small room a theoretical scientist, a businessman of the 'assuring you of our best attention' class, and a teenager. We wonder if they would be able to communicate with each other at all.

There is a complex of reasons for this low standard of expression among intelligent people. Our educational system is partly to blame. Another cause is our (perhaps) unconscious desire to impress others with a string of mysterious sounding words. We are reminded of an impressive five-page memorandum which someone sent to Sir Winston Churchill during the war. He wrote back: 'Do you mean "No" ?' It would certainly have some effect if people who care about plain writing had a similar brusque tilt at any jargon that comes to them.

NEWS *Briefs*

ISRAEL'S FIRST PETRO-CHEMICAL PLANT CASEIN OUTPUT FALLS—MORE DU PONT TYRE YARN — PIRELLI PLANT GOES UP AT TURIN

●**Canada** — Shipments of asbestos from Canadian mines declined 2.1% in April to 96,053 tons from 98,139 in April 1959, but rose 6.3% in the January-April period to 300,847 tons from 282,828 a year ago.

●**United States**—Goodyear Tyre and Rubber announce plans for expansion of production facilities at its vinyl resins plant at Niagara Falls, New York. The cost of the expansion will be 'more than $1m.,' the company said. The new facilities will add about 20 million lb. annually to the plant's total capacity and will double the production capacity for two specialty dispersion resins handled by the Goodyear Chemical Division.

●**Canada** — British Titan Products (Canada) has announced that its new $15m. titanium oxide pigment plant to be built at Tracy, near Sorel, Quebec, is expected to be completed by the summer of 1962.

●**France**—Ground was broken on June 8 in Port-Jerome for construction of The Firestone Tire and Rubber Company's multimillion dollar synthetic rubber manufacturing plant. Harvey S. Firestone, Jun., chairman and chief executive officer of the company, officiated. The plant, scheduled for completion in 1961, will have an initial annual capacity of 10,000 long tons. A new tyre manufacturing plant is also being constructed by the company at Bethune. It will be completed late this year.

●**United States**—The Du Pont Company said it would 'more than double' capacity to produce nylon yarn for tyre cord and other industrial products at its Richmond, Virginia, plant. 'With the completion of this move in the second half of 1961,' a spokesman said, 'our capacity to produce this type yarn will exceed 100m. lb. annually at the Richmond location alone.' Du Pont also make tyre yarn at Seaford, Delaware, and Chattanooga, Tennessee.

●**Poland**—UK goods that can be imported into Poland, it was agreed at Anglo-Polish trade talks, include tyres and tubes (quota £100,000) and various rubber goods, including covered and uncovered rubber thread, rubber belting and rubberized fabrics (quota £100,000). Poland has also agreed to give special facilities for fire resistant belting and synthetic rubbers.

●**United Kingdom** — A 10-years-old Shell oil tanker, the Gyrotoma, has been converted to ship liquid propane gas in large high-pressure steel containers, as well as her normal oil cargoes.

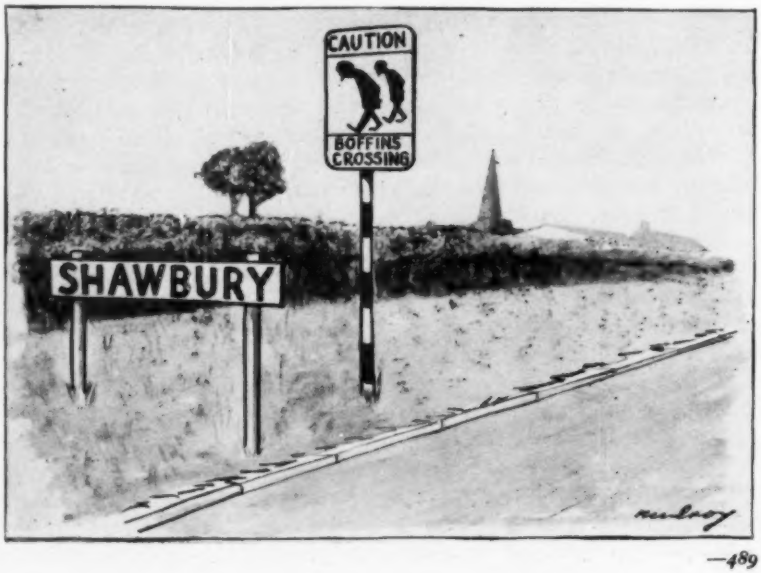
●**Italy**—The Pirelli Company of Milan announces work has started at Settimo Torinese, near Turin, on the construction of a new plant for the manufacture of tyres and car accessories. 2,000 workers will be employed at the plant and production will start at the beginning of 1961. The new plant will manufacture standard size automobile tyres, while the Milan Bicocca plant will be expanded and re-equipped and will concentrate on production of heavy vehicle tyres and special type tyres.

●**Argentine** — Trade quarters said casein production has been seriously affected by the severe dry spell. The week's shipments totalled 712.8 tons, of which the United States took 590 tons, Sweden 60, the United Kingdom 51.4, Germany 10 and Singapore 1.4.

●**United Kingdom** — The 'tremendous growth' of UK imports of American man-made filament fabrics in the early months of this year have been described as a threat by the Rayon Weaving Association. The increase in imports—1.74m. yd. in three months, compared with 156,000yd. in 11 months of 1959—followed the relaxation of dollar restrictions. Most of the imports are said to be lightweight nylon fabric. The Association has discussed with British Nylon Spinners ways and means of meeting the competition.

●**Indonesia**—In talks held in Djakarta between the Indonesian Government and a Mexican trade mission, both countries agreed to extend the scope of their trade relations. In 1960-61, Mexico plans to increase rubber imports from Indonesia to 50,000 tons from the 30,000 tons hitherto imported annually.

●**Israel**—A $5m. plant for producing polythene is to be erected in Haifa by the American investor, Mr Virgin Stark, according to an agreement signed in Jerusalem recently with the Israel Government. The plant will be the first petro-chemical enterprise in the country. A separate agreement between Mr Stark and Haifa Oil Refineries provides for the installation in the refineries of special equipment for an annual production of 9,000 tons of ethylene by the refineries to supply the new plant. It is estimated that the new plant will take two years to build.



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I S R

STRETCH

More Activity From DCL

MURGATROYD'S TO INCREASE CHLORINE PRODUCTION

PLANS to increase chlorine production by 50% at its Elworth, Cheshire, works are announced by Murgatroyd's Salt and Chemical Company Ltd., the jointly-owned subsidiary of Fisons Ltd. and The Distillers Company Ltd. The new plant will cost about £1½ million, and is scheduled to come into production in the latter half of 1961. Murgatroyd's are suppliers of chlorine to the Geon PVC plant at Barry.

Project managers for the expansion are the DCL Engineering Division, and main contractors for the plant construction and installation are W. J. Fraser and Co. Ltd. Bernard Taylor and Associates are the architects.

Expansion Programme

Through DCL, Murgatroyd's is associated with British Hydrocarbon Chemicals Ltd., whose current programme of expansion at Grangemouth, Stirlingshire, includes a new ethylene dichloride plant (*RJIP*, March 26, 465), and with British Geon Ltd., who recently announced a scheme for increased production of polyvinyl chloride at Barry (*RJIP*, April 2, 498).

This expansion means that, so far this year, DCL is connected with more than £10m. of investment in plant producing raw materials which, it is expected, will be mainly taken up by the polymer industry.

BAKER PERKINS BUY GRANBULL

Baker Perkins Ltd., Peterborough, have acquired the Granbull Tool Co. Ltd., which manufactures moulds and equipment for the plastics industry and press tools, jigs and fixtures for industry generally.

The company has been associated technically and commercially with Baker Perkins for some time, particularly in connexion with the Autoblow unit—a Baker Perkins extruder coupled to a Granbull bottle blower, which can produce 960 4oz. plastic bottles an hour. This range has recently been widened to produce mouldings of up to 5 gallons capacity.

The purchase price of £85,000 will be satisfied by the issue of a sufficient number of Baker Perkins ordinary £1 shares on June 20 to yield this amount at the middle Stock Market price immediately prior to that date.

Mr F. G. Bull will remain managing director and Mr R. H. Wilkins, O.B.E., F.C.I.S., will become chairman of the company which will continue to operate as a separate entity within the group. This takeover follows the recent acquisition by Baker Perkins of Rownson (Conveyors) Ltd. for £95,000 (*RJIP* June 11, 886).

DUTCH FORECAST

Total rubber consumption in Western Europe, both natural and synthetic, will continue to rise, a Dutch rubber expert predicted on June 13 in Amsterdam, but most of the increase will be in use of synthetic rubber.

Mr J. G. Loeber made his forecast in the annual report of Insulinde Cultuur Syndicaat, whose main trading product is natural rubber. Among natural producers, the report noted that several African countries were growing in importance as suppliers while Malayan and Thailand output was also increasing. But Indonesia, previously the largest producer, was likely to show a gradual decrease, the report said.

Increasing demand with a slow rise in output might cause a shortage of the natural product. New synthetic rubbers will be offered at below current natural market prices, the report predicted.

MALAYAN REPLANTING

The Malayan rubber industry has replanted 1,250,000 acres of rubber land with new high yielding trees, according to the annual report of the Malayan Planting Industries Employers' Association, released on June 10.

The report said this total was at least five times greater than replantings in other countries. Rubber occupied 3,500,000 acres of a cultivated total of 5,400,000 acres. About $184m. was paid last year to the Government for rubber duties—the highest annual total since the boom days of the Korean war.

The report said that at least one third of Malaya's population was directly or indirectly dependent on rubber for its livelihood. Production, incomes, profit and wages had all shown an upward trend, while unemployment and the cost of living had gone down, although not to a marked extent.

Recticel Join Sutcliffe

A. Tout and Sons Ltd. of Bradford have now joined the Sutcliffe group and have changed their name to Recticel Ltd. All Recticel products will be marketed by Sutcliffe Moulded Rubber Co. Ltd.

Recticel is sheet rubber moulded into numerous square cells and is finding a ready market in upholstery, and in cars as floor trim.

Nylon tyre cord will be produced by a new company formed by Allied Chemical and Polymer Corporation Pty. (Australia).

Polymer Corporation Future

CABINET COMMITTEE STUDIES POSITION

ANSWERING a question in the Canadian House about Polymer Corporation, the Crown-owned synthetic rubber and chemical plant at Sarnia, Defence Production Minister Raymond O'Hurley announced that a cabinet committee had been formed ' to study the future of this company in view of the large exports we have to make to keep this company in operation.'

Reporting this, the Toronto *Globe and Mail* comments Polymer now faces an uncertain future because of the development of the new trading blocs in Europe. *The Globe and Mail* adds that sale of the company to private interests is a distinct possibility, although Mr Hurley answered another question in the House early in March with a firm statement that there were no plans to sell.

It appears likely, states the Canadian paper, that major expansion will have to be undertaken by the company if it is not to lose its markets. This would probably involve construction of a plant within the Common Market tariff wall.

33 at Poznan

Thirty-three UK firms, including Dunlop and I.C.I. are taking part in a combined display at the Poznan International Trade Fair. The British Pavilion covers 16,000 sq. ft., and a display outside it 22,000 sq. ft.

The display has been organized by the Board of Trade and the Fair, which is now on, closes on June 26.

Standardizing Compounding Ingredients*

DIFFICULT TECHNICAL PROBLEMS INVOLVED

DURING World War II the US Government established a system of quality control for synthetic rubber, so that the rubber from any number of plants would have roughly the same properties. As well as agreeing on methods of mixing and curing, naturally compounding ingredients needed to be standardized as well. By 1946 the Rubber Reserve Co. had brought out 14 standards. Two years later the National Bureau of Standards in Washington took over responsibility for the standards.

Then ASTM Committee D-11 appointed a special subcommittee on standard materials, the forerunner of Subcommittee 29 on Compounding Ingredients. This subcommittee requested the establishment of about 20 standard compounding materials which included the standards required for the synthetic rubber programme. By 1959 the National Bureau of Standards had available 17 of these materials, including three standard rubbers.

Criteria for Standards

A satisfactory standard for rubber compounding must fulfill the following requirements. It must be uniform throughout the lot. It must not change appreciably before use. Successive lots of the standard should have the same characteristics for the intended use.

Many of the 14 materials established as standards by the Rubber Reserve Co. did not meet these requirements. After an extensive study, the formulations for testing synthetic rubbers were simplified and six of the 14 materials were eliminated. Experience showed that it was very difficult to reproduce the lower commercial grades used in the rubber industry because of the many active impurities present. Therefore, many of the standards were replaced when the formulations were changed. The highest purity materials commercially available were selected for these replacements. Even the small amount of impurity in the best commercial grades gives considerable difficulty in reproducing lots of some standards.

The original standards were distributed in the customary commercial containers, which were paper bags in some instances. It was found that some materials packaged in this manner changed irreversibly during storage and could not be used after a short time. Therefore the compounding ingredients were packed in air-tight metal containers. The rubbers were wrapped in polythene and packaged in paper bags.

The stability during storage of the standards and proposed standards is being studied. Surveillance of the established standards is maintained to determine when appreciable change in their characteristics has occurred. Portions of the various materials are being stored under four different temperature conditions ranging from −20° to +40°C. and periodic tests are being made. Among the NBS Standards for Rubber Compounding, the only change noted is a slight increase in Mooney viscosity of one of the styrene-butadiene rubbers, SBR-1500.

On the other hand, studies made on materials proposed for use as standards indicate that many of the materials used in the rubber industry are not sufficiently stable for this purpose.

Sampling and Testing

In the case of replacement lots of compounding ingredients, several portions are selected at random from the lot prior to packaging. These portions are compared with the previous standard of the particular material to ascertain their equivalence in a standard rubber compound. Generally, four compounds are prepared from each portion and at least four compounds from the previous standard.

The uniformity of the lot is judged from a sample taken during packaging. Experience indicates that 8 to 13 portions selected at predetermined periodic intervals give a suitable sample. Each portion is tested separately in a standard rubber compound. A statistical method is used in order to eliminate small errors attributable to the sequence or day in which the compounds are mixed.

The rubber compounds are prepared in accordance with the appropriate standard formulation and mixing procedure in ASTM Designation D15. The compounds are mixed on a mill having rolls specially designed to maintain their surface temperature constant within 2 Celsius degrees'. All operations are conducted in a room conditioned at 23° ± 1°C. and between 35 and 40% relative humidity.

The viscometer cure characteristics of the compound are determined at either 125° or 150°C., between two and four hours after mixing by the procedure described in ASTM Designation D1077. In addition to the time of incipient cure (t_5), the time required for the viscosity to increase from 5 to 35 ML points above the minimum is recorded as the cure index (Δt). The parameter Δt is inversely related to the rate of cure.

Vulcanizates approximately 15 x 15 x 0.2cm. are prepared in accordance with ASTM Designation D15 using a chromium-plated, four-cavity mould machined directly in the hot plates of the press. The press is equipped with a special temperature controller which maintains the temperature of the plates constant within 0.1 Celsius degree. This equipment produces vulcanizates that are uniform in thickness within 0.02mm.

The following tests are made on the vulcanizates:

Test	ASTM Procedure
Strain under a fixed load	D 1456-57T
Stress at a fixed elongation	D 412-51T
Stress at failure	D 412-51T
Elongation at failure ..	D 412-51T
Electrical resistivity* ..	D 991-48T†

* Measured only on compounds containing carbon black.

† Modified as described by McKinney and Roth.[2]

Analysis of Results

A statistical analysis is made of the results for each property. The several analyses are examined for trends or other evidence of non-uniformity in the material. The results for most standards for rubber compounding show no evidence of heterogeneity in their effect on vulcanization characteristics. In the few instances in which some heterogeneity has been observed, either the variability is slight—*i.e.*, not significant at the 1% level—the portion of the lot exhibiting the variability is not included in

* *From a paper delivered by F. L. Roth and R. D. Stiehler at the International Rubber Conference held in November in Washington.*

the standard sample, the lot is reblended and retested, or a new lot is prepared.

In the case of the rubbers, no attempt is made to reproduce the previous lot exactly. Instead, the most probable values and their uncertainties based on a confidence coefficient of 95% are determined and issued as a certificate with the standard. In calculating the uncertainty limits, allowance is made for intrinsic error of test and systematic effects associated with both sequence of mixing the compounds and day of mixing. In those instances where there is a slight heterogeneity in the material itself, the uncertainty limits also reflect this variability. Accordingly, the uncertainties given in the certificates for the rubbers are generally larger than would be indicated by the intrinsic error of test which is used to judge the uniformity of the lot.

Problems Encountered

(Numbers referred to after compounds are NBS Standard Sample numbers.)

Zinc Oxide (370). The original standard established by the Rubber Reserve Co. was made by the American process. Attempts to reproduce the material were not successful. In 1948, a high-purity zinc oxide made by the French process was chosen for the standard. No difficulty has been encountered in reproducing this material.

Sulphur (371). A distilled product of high purity has been used for the standard. There has been no difficulty in reproducing it.

Stearic Acid (372). The original material chosen for the standard was the highest quality available at the time. It contained some impurities that had a pronounced influence on the vulcanizates of rubber compounds. It was not possible to reproduce the original standard. A distilled stearic acid of low iodine number which is equivalent in rubber to CP stearic acid was therefore chosen for the standard. This high quality material has been reproduced twice without difficulty.

Benzothiazyl Disulphide (373). A commercial material is used for the standard. Although the original standard has been reproduced twice, testing of many lots is required to obtain one satisfactory for the standard.

Tetramethylthiuram Disulphide (374). The standard is a commercial material that has been reproduced once after testing a number of lots.

Channel Black (375). This standard has been reproduced several times, but only after testing many lots. The several lots have had detectable differences among them, but the differences have been small enough so that they could be used for specification testing. Special blending of the lot has been necessary to attain the desired uniformity.

Magnesia (376). The original Rubber Reserve Co. standard has been replaced with a lot having an appreciably different effect in polychloroprene. It has also been difficult to obtain a uniform lot of this material.

Natural Rubber (385). Extensive investigations during the past 10 years were conducted to obtain a uniform lot of rubber having the desired properties. Liberian crepe produced under carefully controlled conditions was finally selected for this standard. The rubber was produced on two days. There was a slight difference between the two lots of rubber, but each lot was uniform within itself. Accordingly, the lots have been individually certified.

SBR-1500 (386). Replacement lots of styrene-butadiene rubber, type 1500, have been similar even though no attempt was made to reproduce the original exactly. There has been some difficulty in attaining the desired uniformity within the lot. The Mooney viscosity of this material has also changed slightly during storage.

SBR-1000 (387). This standard is more stable than SBR-1500, but is comparable in uniformity.

Conclusions

The standards for rubber compounding have been useful in the standardization of testing in the synthetic rubber plants. Their success in this application has resulted in their use by other rubber laboratories. However, the establishment of these standards has been and continues to be a difficult technical problem. The difficulties have been alleviated whenever a high-purity material has been obtained. A number of specifications for compositions of standards are given below.

Sulphur (371)

Purity	99.90% min.
Loss at 100°C.	0.05% max.
Ash	0.02% max.
Insolubles in CS_2	0.10% max.
Insolubles in benzene	0.10% max.
Organic material	0.05% max.
Acidity as H_2SO_4	0.005% max.
Physical state:	
Through 100-mesh sieve	100%
Through 200-mesh sieve	90 to 95%

Channel Black (375)

Loss at 100°C.	2.00% max.
Ash at 550°C.	0.15% max.
Physical state:	
Retained on 325-mesh sieve	0.10% max.
Retained on 30-mesh sieve	0.001% max.

Natural Rubber (385)

Rubber hydrocarbon	92.0% min.
Volatile matter	0.5% max.
Ash	0.5% max.
Dirt (retained on 325-mesh sieve)	0.05% max.
Copper	0.0004% max.
Manganese	0.0005% max.

SBR-1500 (386)

Volatile matter	0.75% max.
Ash	1.50% max.
Rosin acid	5.00 to 7.25%
Soap	0.50% max.
Stabilizer	1.00 to 1.75%
Bound styrene	22.5 to 24.5%

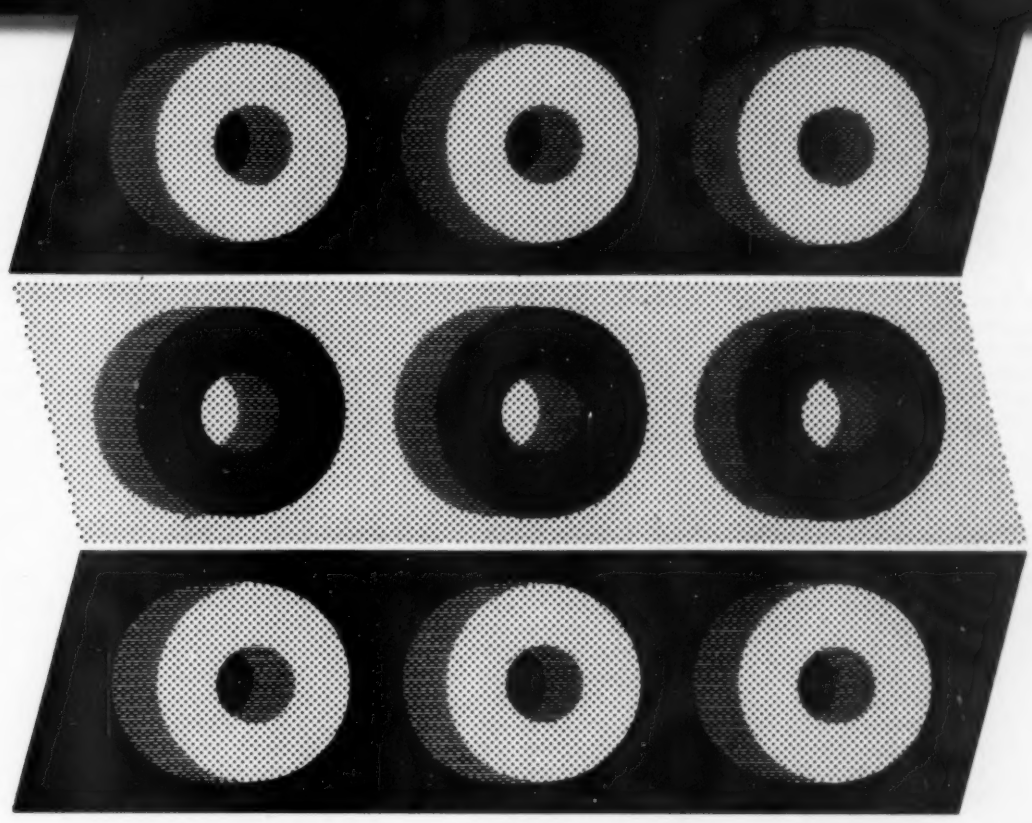
References

[1] Roth, F. L., Decker, G. E., and Stiehler, R. D., 'Temperature Control During Mixing of Rubber Compounds,' *Rubber World*, **132**, 482 (1955); *Rubber Chem. and Technol.*, **28**, 1157 (1955).

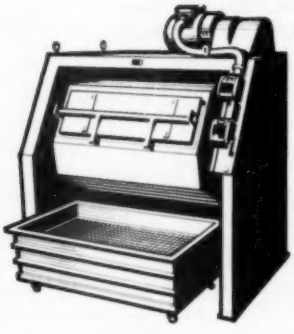
[2] McKinney, J. E., and Roth, F. L., *Ind. Eng. Chem.*, **44**, 159 (1952).

Mr Karl Silk has ceased to be managing director of Jury Holloware and Mr R. B. Williams has been appointed in his place. Mr Williams has relinquished his office as secretary and Mr J. C. Bishop appointed secretary.

As part of their rubber department expansion programme, a Berstorff 60in. twin rolling mill has been installed at Phoenix Rubber's Slough factory. Supported on 45 tons of concrete to a depth of 3ft. 6in., it was installed by the firm's engineering department. The company says this is a result of their rapid expansion in the manufacture of pvc compounds, which has necessitated the establishment of a separate rubber factory



Solve those de-flashing problems with **'DRIKOLD'** in the Columbian International sub-zero tumbler.



When small rubber components are frozen with 'Drikold'—I.C.I. solid carbon dioxide—in a rotating drum, flashes become brittle and break off with the tumbling action. Sub-zero de-flashing with 'Drikold' will increase production—for instance, complete multi-cavity mouldings can be tumbled to produce clean components efficiently and economically. I.C.I. Technical Service staff are available to advise on your problems, and will de-flash sample batches on request.

Sub-zero tumblers are obtainable from
Columbian International (Great Britain) Ltd.,
116 Cannon Street, London, E.C.4.

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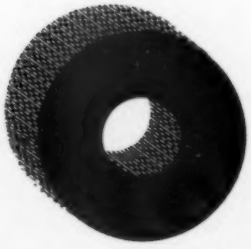
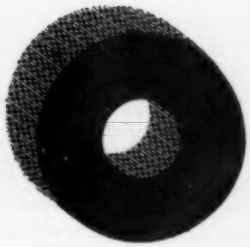
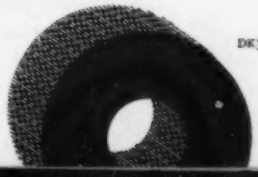






DK318

Additions to BIPEL Range

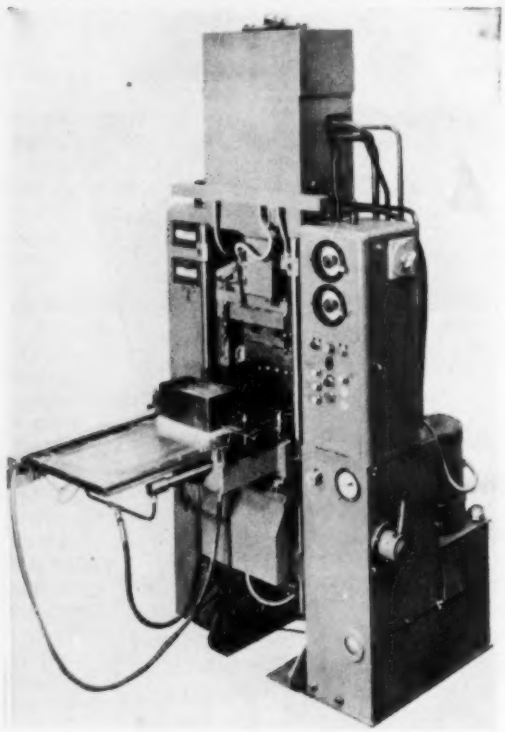
FULLY AUTOMATIC PRESS AND DUAL PURPOSE INJECTION COMPRESSION MACHINE

THE formation of B.I.P. Engineering Ltd., manufacturers of the widely known BIPEL range of moulding machines, was the result of attempts by the Streetly Manufacturing Company to design and build a properly engineered machine for compression and transfer moulding. After several years of experimental and development work a very successful auto-control press had, among others, been produced, and because of the demands of visitors to know if they too could have similar presses, B.I.P. Engineering Ltd. was formed in 1949 for the marketing and manufacture of these machines.

Since that date the company has gone from strength to strength, the wide range of machines is now sold in over 30 countries throughout the world, and the factory has been extended to almost nine times its original size.

As manufacturers of moulding materials, and moulders of a wide range of materials and products, B.I.P. are well equipped to design machines, being able to appreciate the difficulties from both ends of the scale as it were, and this is confirmed by the fact that they have an excellent reputation for building good, robust, reliable machines.

Two recent additions to the range, which have been installed at Streetly and are now in production, are a 20 ton fully automatic compression press, and a 32oz./600 ton dual purpose injection/compression machine.



Front view of the 20-ton BIPEL fully automatic compression press. This is the latest addition to the BIPEL range, which now comprises 20, 60, 80 and 150 ton presses. All electrical controls are visible, including the two pyrometers, and the time clocks of the sequence cycle control

20 Ton Automatic Press

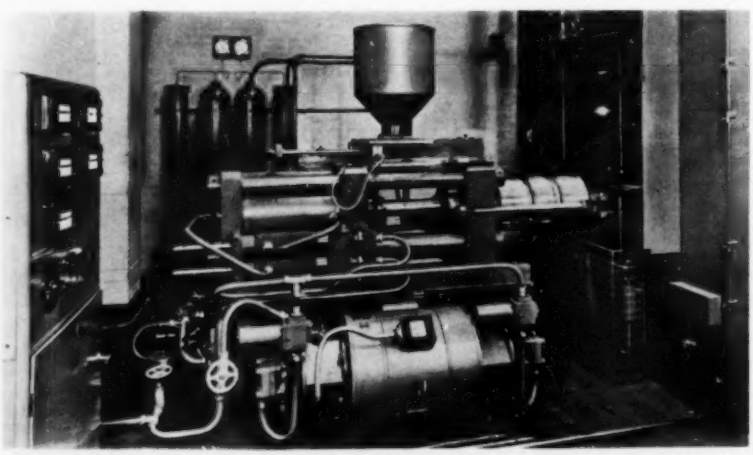
This small fully automatic press incorporates many of the basic features of the 60, 80 and 150 ton presses, but modifications have been made to reduce the cycle time, and simplifications to reduce production costs.

Apart from small hydraulic valves controlling ejectors and loader, the hydraulic gear is totally enclosed and the press is entirely self contained. The stripper plate is attached to the front of the loader and both move together, thus allowing all the auto gear to be on one side of the press. The complete moulding cycle is sequenced, and provision is made for one breath, length of cure being set by one time clock and breath by another. The heat control is by newly developed units made by the Industrial Pyrometer Co., two dials which are readily pre-set are provided, one for each platen of the tool. The speed of operation is very fast, the open time being only five seconds, and the tool changing has been simplified, complete access to the tool being gained easily and quickly by swinging the loader stripper gear aside.

32oz./600 ton Dual Purpose Machine

Designed to meet the growing demand for a vertical locking press capable of high production rates in processing thermoplastics, the new BIPEL injection unit when coupled with a standard compression press of suitable locking force provides a unit capable of high performance in both thermosets and thermoplastic materials. The injection assembly, consisting of a hydraulic power cylinder, hopper, feed and plasticizing chamber, is mounted on slides, and can be brought into position and

Continued on page 935



BIPEL dual purpose 32oz./600-ton machine. Unique productive injection/compression unit

Papers from Paris

AGEING AND HEAT RESISTANCE OF ELASTOMERS DISCUSSED

'AT the present time there is a great demand for rubberlike materials resistant to high temperatures and chemical influence,' said Madame Lamm of the Research and Testing Laboratory of the French Rubber Manufacturers, in her lecture entitled 'Fluorinated Elastomers.' Natural and synthetic rubber could be used up to about 100°C., butyl and Neoprene up to about 130°C. and Hycar up to about 150°C. when normally compounded. The use of TMT could improve the resistance of natural rubber and the use of resins for the curing of butyl also improved the heat resistance. There were, however, no rubbers which had a useful service life above 200°C.; not even silicones and fluorcarbons could be used at such temperatures. In addition the silicones had poor resistance to solvents and chemicals.

Work on the replacement of carbon by fluorine was begun around 1930 and finally resulted in the production of Teflon and Kel F. The fluorine acted as a protection against oxidation. Kel F. was somewhat less resistant than Teflon but easier to process. The introduction of methylene groups made the product more flexible and also vulcanizable.

Another material of good chemical resistance was Viton.

French Production

In France, four companies were collaborating to make a number of these products. Kel F. 3007 was particularly designed for good ageing and 5005 for resistance to acids. Resins of high molecular weight were used for curing. Three latices would also be produced, 2007, 5007 and 8020.

The cured material would resist hot solvents. 5005 cured by resin 820 would resist nitric acid but was attacked by polyesters. The rubbers could also be cured by isocyanates. Zinc oxide was added as an acceptor for hydrofluoric acid. Reinforcement was best achieved by the use of special silicas. Carbon black could be used except in the presence of amine curing agents and for plasticizing DOP or diethyl sebacate. The shrinkage of moulding was greater than with all other rubbers because of the lower filler content.

These were speciality high cost materials so that small mixes were usual; nevertheless mixing should be continued for 20 minutes after all the filler had been added. This also gave better flow in the mould, probably because of a thixotropic effect. Long cures were usual and a trouble that could be experienced was that individual pieces did not join up readily in the mould.

Kel F. 5005 with resin 820 gave mouldings which had a poor appearance but which extruded well. Epoxy resins could be used with Kel F. The molecular weight of Kel F. was about 1,000,000, Viton A about 100,000 and of Viton AHV about 200,000. The low temperature resistance of these materials was not very good but the heat resistance was excellent. Viton B resisted ionizing radiation and was in some ways halfway between A and AHV in its properties. Magnesia was a good accelerator. Zinc oxide and litharge conferred good corrosion resistance but were inclined to give mixes that scorched readily. Viton should be mixed cold, the mix allowed to stand over night and then worked well. In general the lower the vinylydine fluoride content the less easily the material vulcanized.

Amongst curing agents, blocked amines were used, such as curing agent No. 2 which was carbonate of ethylene diamine. Di-imines could also be used. Mono, secondary and tertiary amines were active. A mixture of tertiary and primary was sometimes useful. Another method of curing was to use gamma rays followed by heating. Vulcanization was probably due to the removal of HF from two adjacent atoms which were thus cross-linked. The action of diamines was not fully understood.

In the fluorosilicones, fluoroalkyl groups were used. The low temperature resistance was not outstanding but materials could be used from −70°C. to +200°C. and had good solvent resistance. A press cure must be followed by an oven cure. Viton A could be cured by radioactive cobalt and this had been carried out at the Atomic Research Station at Saclé.

Aeronautical requirements now called for rubbers which could operate from −55 to +250°C. Tubes were needed which would resist acids, fuels and oils and in the near future the range of temperature for which service should be possible was likely to be from −90°C. to +1,000°C. or more. The limit had been reached in carbon to carbon structures so that inorganic or semi-organic compounds such as phosphonitriles and fluorophosphonitriles were now being investigated.

'Influence of the Non-Rubber Components on the Ageing of Unvulcanized and Vulcanized Rubber,' was the subject of the paper read by Miss Boucher and Mr Carlier of the French Rubber Institute. Miss Boucher said that ageing was a most important problem. As a result of the original work of Moreau and Dufraisse in France many products which improved ageing had been developed. It was the non-rubber constituents that acted as anti-agers —if they were removed, for example, by acetone extraction the rubber soon perished. The amount of non-rubber constituents varied considerably between different lots of rubber as was shown by the variation in the rate of cure which was also influenced by the non-rubber constituents. These had an effect both in uncured and in cured rubber but in the latter case the effect tended to be masked by that of the added synthetic anti-oxidants.

Recent Work

The non-rubber constituents had been examined both in uncured and cured rubber. In one series of experiments two sets of samples were prepared, (1) the whole latex was dried at about 60°C. to give a rubber containing 87-88% hydrocarbon and (2) rubber was prepared from the same latex by repeatedly centrifuging and diluting, coagulating, washing and drying. The final product here contained 98% of rubber hydrocarbon—a little soap was present due to the method of preparation. The nitrogen content of the rubber from (1) was 0.87% and from (2) 0.028%. The non-rubber constituents consisted of the following approximate amounts: Fatty acids 1%, waxes, sterols, phospholipides and higher alcohols 0.5%, sugars 3.6%, amino acids 0.5%; amines 0.5%. The figures varied from rubber to rubber.

Experiments were carried out by putting back the extracts into purified rubber. In uncured rubber only amines, phospholipides and amino acids were found to exert a protective action against ageing. In vulcanized rubber only phospholipides

and amino acids were active and these to a less extent than in uncured rubber.

The main influence of the amino acids was to influence the rate of cure, especially when MBT was used as accelerator.

Alternative Protection

Miss Boucher's remarks were followed by a lecture by Mr Carlier. Since there was no common solvent it was not possible to reintroduce the extracted non-rubber constituents except by mastication. When, however, the non-rubber constituents which had been extracted by alcohol were put back, the original ageing properties were substantially restored. Nitrogen compounds, phospholipides and amino acids exerted a protective action but there was a synergestic effect. 2% of the amino acids such as glycine or alanine would protect just as well as, or even better than all the non-rubber constituents when added together.

It was interesting that if the rubber was completely dry these acids were not effective—a trace of water was needed. All accelerators except the dithiocarbamates were pro oxygen—they caused increased oxidation but the zinc dithiocarbamates were excellent antioxidants for non-vulcanized rubber.

The non-rubber constituents also acted in most cases as accelerators of vulcanization but this effect was not observed with the sulphenamides. The purified rubbers clearly showed a greater tendency to oxidation when aged at 60°C.

M. Jean L'Eveque deputized for Dr J. le Bras in giving a lecture on rubber and plastic foams in which he said that great importance was attached to comfort under modern conditions of life. Plastic foam had made more rapid progress than rubber foam, firstly because it was cheaper and secondly because its properties had been modified so as to approach those of latex foam more and more. Polyethers were at least 25% cheaper than latex foam, particularly in view of recent increases in the price of natural latex. Synthetic latex could, however, be used with natural latex. The price of latex represented ¼ to ¾ of the cost of the finished article.

Reducing Cost of Latex Foam

Manufacture could be modified in several ways in order to reduce the cost. The normal ratio was 60% solids to 40% air and this could be changed, stiffening the rubber portion by fillers. Whiting was cheap but reduced flex and tear resistance. Talc, mica and clays were used and some could be added directly to the latex. Special silicas gave better flex characteristics. Glass fibres 3-4mm. long increased the tear resistance but reduced elongation at break and hence the flex resistance. Grafting on of methyl methacrylate could be used but did not greatly reduce cost. The French Rubber Institute had tried the direct introduction of melamine resins but these diminished the flex resistance.

It was also possible to impregnate the foams by means of formaldehyde resins or even sodium silicate but the impregnation was soon destroyed and special apparatus was needed. It was, however, a method of recovering soft rejects to make them saleable. Oils could be used with the stiffeners to improve the flex resistance.

All the methods above described tended to diminish the quality and hence standards had been set up in many countries although not yet in France.

Attempts to obtain a lighter foam with the same characteristics were not successful. One property always suffered.

New Methods

In 1958 the French Rubber Institute took out a patent for the use of starch. Many kinds of starch could be used. A starch paste was employed. In order to minimize the settling of the ungelatinized starch granules a portion of the granules should be gelled. A suitable formula was: rice starch (powder) 97, rice starch (gelatinized) 3, water to 250. This mixture was added at the beginning of the beating process, seven parts starch per 100 dry rubber being the optimum quantity. If this quantity was exceeded the foam was of inferior quality. Neither the drying nor the curing was affected by the starch. The shrinkage was increased a little but this was only noticeable in large mouldings such as mattresses.

Washing was an essential part of the process in order to remove excess of sodium silico fluoride, and this washing tended to remove some of the starch. The removal could be avoided by adding tannins. For example, if five parts of oak tannin was used in the above formulation this prevented the starch from being extracted. Good results had been obtained using potato starch and tannic acid. Here washing appeared actually to improve the physical properties.

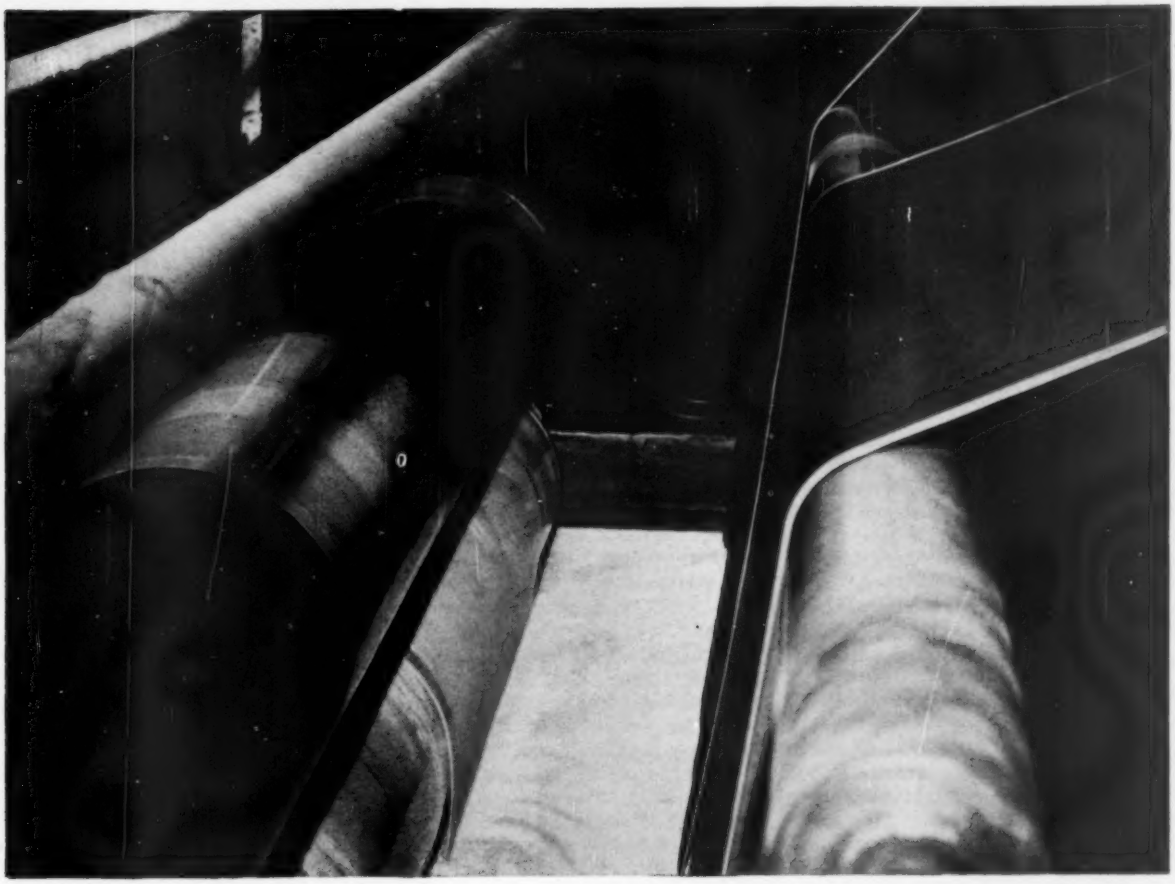
Another way of cheapening latex foam was by the use of bitumen emulsions. 10 to 20% of the latex could be replaced by such emulsions. Gelling was made difficult, however, and the colour was made darker, but the physical properties of the foam were good. The compression modulus of foams containing these various materials had been determined by the methods of the ASTM. The ageing had also been investigated, the change in compression set on ageing having been measured. This was found to be as follows:

Reference sample	+14%
Sample containing starch	+13%
" " bitumen ...	+11%
" " starch and bitumen	+ 9%
Sample containing starch and whiting	+ 4%
Sample containing whiting ...	− 4%

The average specific gravity of the foams mentioned was 0.001 to 0.013. A foam having an apparent gravity of 0.102 could be obtained with a compression modulus of 590 grams per square metre. The cost of the mix was calculated and compared with that of the reference sample having regard to the compression ratio. The cost of 10 cubic metres of foam was expressed as a fraction of the 50% compression modulus, this being a useful way of seeing what economies had been possible. In commercial practice a foam containing 7% of bitumen and 10% of starch had been found to be satisfactory.

Latex foam development was retarded by the high cost. Synthetic latex did not give the correct characteristics and even if a synthetic latex were found which gave these characteristics there would still be competition from the polyethers. Hence reinforcement of the cell walls rather than simply making these more rigid would be a useful step forward.

Fishing float which is claimed to withstand pressures equivalent to a depth of 70 fathoms without noticeable loss of buoyancy. Made by Brodr. Surde, Spjelkavik, Norway, from rigid cellular Geon PVC



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Round the World

GERMAN LINING — POLISH INHIBITOR — BRICKS OF PETROL

FROM Germany comes news of a method of lining vessels of all kinds used in the chemical industry. These must be resistant to chemical, thermal and mechanical attack, as well as to swelling. The use of plastic-impregnated graphite plates is advocated as the most satisfactory solution of the problem. In June 1959 no fewer than five new petrochemical plants were scheduled to begin operations in Japan, with the aim of producing more synthetic fibres to promote the nation's biggest industry—textiles—in world trade. There has been a dramatic change in Japan's petrochemicals - plastics position. In effect, Japan has moved from being a buyer to a seller in a matter of four years. This expansion is illustrated by the fact that the plastics section was the biggest at the Osaka Trade Fair in April.

Much investigation has been carried out in Poland and the USSR into volatile inhibitors of corrosion, especially under tropical conditions. The volatile inhibitors, especially of the type of dicyclohexylammonium nitrite, proved much less effective than certain greases, but both together, such as this nitrite, urea, mixed urea and sodium nitrite, together with a thin-layer (laminated) grease, proved more effective. The French have developed film-forming amide polymers from drying oil fatty acids, and among these is a new class of polyamides that yield film-forming products resistant to chemical reagents.

Japanese Fibre

A fibre has been developed by European companies under Japanese patents which is said to combine the strength and ease of care of cotton with the drape of rayon and the lustre of silk. It is somewhat more expensive than rayon, but less than half the cost of the other synthetics. An insulating material made of cellulose triacetate has been developed in Japan, and is being used as a base for gramophone records and tape, as a packing material, and in small electric motors. It is both an electrical and a heat insulator.

In Australia, a large company is attempting to build a world-wide sales demand for an all-plastic sports shoe which is made in a single moulding operation—fifteen seconds to the shoe, yet the company has been in existence only two years.

Plastics are increasingly taking command of the toy market. Since the hula hoop craze introduced high-density polythene to toymakers, this tough plastic has gone into everything from dolls houses to child-carrying wagons. Vinyl and high-impact polystyrenes are also finding novel applications. Japan and Germany are coming into this market on a large scale. In Jugoslavia, the utilization of powdered metal in organic resinous binders for use in coating surfaces to protect them is being investigated.

Nickel Coats

Many plastics are now being coated with nickel, after they have first been made conductive by a special treatment, to render them suitable for electroplating.

Soviet scientists are coating tiny droplets of petrol in plastic and combining these drops into solid bricks of fuel. They report that these 'bricks' contain 95% petrol by volume, and can be burned like lumps of coal at temperatures as low as −87°C. They can, if required, be pressed back into liquid petrol by a special machine.

Two European organizations, one in Italy and the other in France, have recently developed successful methods for preparing polypropylenes for conventional dyeing. The Italian company has shown brightly-hued fabrics made of the staple and yarn. The French state that their technique allows of the manufacture of fibres and fabrics, which can be vat- and spun-dyed in the full spectrum of basic and acid colours.

A Japanese company has put on the market a polyester body which can be fitted over the chassis of an old car. The cost of overhauling runs, it is stated, from £180-£250 for a small automobile. The body itself weighs about 30% of comparable conventional metal body styles.

Two German companies have developed water - soluble varnishes. As compared to conventional varnishes containing organic solvents, the new varnishes have a number of advantages. Organic solvents are expensive, and the danger of fire is eliminated, while any wasted varnish can readily be eliminated. Moreover, water-soluble synthetic resins have unusual adhesive properties, so that extremely thick first coatings are possible.

The French have developed a new process for manufacturing foam rubber goods, such as shoes, slippers, gloves, hats and various industrial items. It is fully covered by patents, both in France and in this country, and is secret. The process can easily be begun in existing premises or in a plant already manufacturing rubber articles. General manufacturing and marketing licences are said to be available in any country or group of countries.

In the pickling of steel parts in sulphuric acid solutions, it is customary to incorporate in the acid bath an inhibiting agent designed to prevent the acid from attacking the steel too severely. In the USSR organic inhibitors have been studied, with the result that o-Tolylthiourea and phenylthiourea are being recommended for this purpose. From France comes news of a patent taken out for the protection of elastomers from the effects of sunlight and atmospheric ozone. Olefinic elastomers, in either solid or latex form, can be protected from these harmful effects, it is claimed, by embodying in the elastomer, at the end of the mixing cycle, from 0.1 to 5% (preferably 1 to 2%) of a nickel xanthate (alkyl-xanthate, alicyclic xanthate, aryl-xanthate, or aryl-alkyl-xanthate). Titanium oxide, at least one microcrystalline wax and an amorphous paraffin, and an anti-ozone substance chosen from the following may also be added to the elastomer: diphenyl-*p*-phenylenediamine, zinc mercaptobenzamid-azolate and dinaphtyl-paradiphenylenediamine.

Cathodic Protection

The use of rubber in the cathodic protection of ships by magnesium anodes is being advocated in some circles in Germany. The cylindrical anodes are connected to the ship's hull and surrounded with a thick-walled rubber ring, which is intended to prevent the increased current densities liable to cause injury to the paint protecting the hull. From Germany also comes news of a new use for plastics in the surface protection of metals. There are two processes often used for applying thin coatings,

the whirl sintering process and the flame spraying process. It is suggested that high polymer plastics might be deposited by these two processes with satisfactory results, but this application sets up problems which are still in process of being solved.

Liquid plastic applied to hot metals by a new process has the advantage of not cracking or chipping during application. Coatings can be applied accurately in a wide range of thicknesses and are corrosion-resistant. One interesting application is to the painting of long pipes, both inside and outside. A South African scientist has developed the technique, which a large group of companies is promoting throughout the world.

Cashew nuts are one of the exports of East Africa, most of them going to India in the shell. The latest development is the recovery of the cashew nutshell liquid (CNSL) by grinding the shells and then extraction by counter-current solvent. The shells contain approximately 30% CNSL. A vesicant toxic substance, this is employed in the production of a number of thermosetting resins and in the manufacture of some linings of automobile brakes. The new extraction process is said to show how waste materials can be utilized when mechanical shelling is introduced.

A Dutch company has announced that it proposes to undertake shortly the growing of rubber in Liberia. A concession has already been promised by the Liberian Government. The enterprise will be entirely financed by the Dutch company, which will have sole control. A serious disease has been encountered in the heveas since 1956, and has manifested itself in the Far East, Africa and Central America. It is caused by two fungi, and affects the leaves, the leaf stalks, the green twigs, the fruits, and sometimes the flowers. The damage done by this parasite is extremely serious, weakening the plants attacked and delaying their growth. Experiments are being carried out to discover an anti-cryptogamic, and so far the best results have been obtained with dimethyldithiocarbamate of zinc and iron.

The continuous polymerization of butadiene nitrile acrylic rubber has been tried out in the USSR, and it is claimed that this method is much superior to the discontinuous polymerization process hitherto used. Stabilization during polymerization as well as the ability to coagulate the latexes thus obtained are both said to be excellent.

ELECTRICITY'S ROLE IN INDUSTRY

'In many industries, such as rubber and plastics, electric power has not only replaced steam and other forms of power but in many instances the products could not be made at all without the speed, accuracy and concentration of power which electricity makes possible,' said the Hon. H. G. Nelson, managing director of English Electric. He was speaking at the twelfth electrical power convention, held recently at Bournemouth. As a striking example he quoted polythene whose production required great pressure. This could only be achieved, he said, by using powerful electric motors specially designed for the purpose and for operation in an explosive atmosphere.

Mr Nelson said that, broadly speaking, electricity featured in industry in three main ways. First as a processing element; secondly, as a source of power and thirdly as a means of control. The most valuable contribution which process electricity might be expected to make in the next few years was to facilitate the introduction of new materials, and to reduce production costs.

The use of electricity in control systems ranged from the automatic lift to chemical process plant controls. Automatic control and data processing was expected to make significant progress in the next few years.

BIPEL RANGE

Continued from page 930

retracted at the touch of a button. This injection unit, which is mounted on a base plate incorporating the hydraulic unit and power unit pump is connected to a standard compression press through a special throughput tube, a turn round block and standard nozzle. This nozzle is arranged to protrude through the bottom platen of the press and the bottom mould attachment platen is fitted on top with the standard ejector gear. An unusual feature is the injection ram pressure control, by which the injection plunger can be brought forward at high speed under high pressure and then transferred to a preset pressure for the final injection squeeze. A device is incorporated to compensate for variations in material feed, so that the final controlled pressure stroke is always the same length.

The high speeds and standards of moulding which are possible with this combination of injection and compression will, it is felt, result in the combination press finding its place in the moulding industry as a whole.

Mr Khruschev, accompanied by half the Praesidium Central Committee, recently visited the I.C.I. Plastics Division exhibition in Moscow (*RJIP June* 11). **He said that he welcomed this kind of informative exhibition.** (*Left to right, top*) **B. Pidgeon (export manager, R. H. Windsor), J. W. B. Peel (I.C.I. East European Department) with Mr Khruschev.** (*Bottom*) **Sir Patrick Reilly (British Ambassador in Moscow), Mr Khruschev, J. C. Swallow (chairman I.C.I. Plastics Division), Dr J. S. Gourlay (I.C.I. Overseas Director), J. W. B. Peel. The exhibition moves on to Leningrad next month**

Samafor Extruders

SINCE the end of last year Dimon (England) Ltd. have been marketing the Samafor range of extruders in the UK. These are manufactured in France and imported complete, and the machines available range from an extruder with a 30mm. screw diameter and a L/D ratio of 20, to a 120mm. vented machine with a L/D ratio of 26.

The machines are equipped either with a constant speed motor and six speed gear box, or a variable speed motor. The standard motors fitted are French, but British motors can be supplied to customers' requirements, a 65hp motor being recommended for the largest machine, which has an output of 485lb./hour using LD polythene at 400°F. and 2,000 psi.

Barrel construction is of nitrided steel, which is also used for the one piece screw and thread of the two smallest machines. The larger machines have screws of nickel chrome steel with stellite threads, and in all cases screw and thread are hard chromed.

Unless otherwise specified the temperature controls are Ether Wilco 991 Transitrol, and the number of heating zones, which consist of electric resistance rings embedded in the barrel, varies from two on the smallest to six on the largest extruder. The time to heat up to 350°F. is 20 minutes for all sizes. The cylinder cooling is by a forced air system, and the hopper has a water circulatory system.

All the extruders have been used successfully for a wide range of materials including acetals, acrylics, cellulosics, PVC, nylon, and polythene, but the range of vented machines is recommended in many cases.

Samafor have a large laboratory which is well equipped with a complete range of extruders and all the ancillary equipment which is also manufactured by the company, and this is at the disposal of all present and possible customers.

CORRESPONDENCE

Import Opportunity

To The Editor

Sir,—We are a well-known Norwegian supplier of plastics household goods with a very varied production.

We are looking for a representative in Great Britain, or, if possible, an interested importer.

NORWAY

[Letters from interested readers will be forwarded to this correspondent. —Editor.]

Low Cost GRP for Electrical Parts

A new low cost fibreglass mat/polyester resin laminate containing flame retardant filler is being produced by Permali Ltd. It is normally supplied in sheet form, standard size 34in. x 34in., and the company recommends it for use on electrical equipment as busbar supports, phase barriers, arc barriers, operating levers, terminal strips, switch plates, armature end cheeks, slot wedges, coil end cheeks, contact bases and mechanism covers. Further applications are being investigated.

This material is claimed to provide the established electrical and mechanical properties of polyester glass fibre materials at a lower cost.

Derrick Davis Plastics Ltd. have moved to Orkney Works, Orkney Street, S.W.11 (Macaulay 8666-8882).

IRI at School

FIVE hundred school children from schools in Burton-upon-Trent and surrounding districts were present at a special young people's lecture arranged by the Burton-upon-Trent section of the IRI, when Professor Bawn of Liverpool University talked about rubbers, plastics, and fibres.

Professor Bawn explained that synthetic rubbers, natural rubbers, fibres and plastics were organic chemicals which differed from the common organic chemicals like cane sugar and petroleum in that they had unusual mechanical properties. He showed, in the simplest terms and with the aid of slides and experiments, the difference between these forms of matter, and gave an account of the chemistry underlying each of them.

The talk was followed by a discussion after which Mr Gillion, head of the School proposed a vote of thanks to the speaker. Mr Blake, chairman of the section, closed the meeting by pointing out that the rubber and plastics industries offered considerable scope for scientific careers and he thanked the educational and Grammar School authorities for their co-operation. In addition to the lecture, an exhibition was organized showing various rubber and plastic products. Exhibits included tyres, footwear, frogman's suits and inflatable dinghies. Numerous moulded items were also on show.

Mr H. I. Matthey has been appointed to the board and chairman of Ship Carbon Company of Great Britain in succession to Mr A. L. Stock who has resigned from the board. Mr R. S. Silman has been appointed managing director in place of Mr J. S. Woods who has relinquished the post. Mr A. W. Edward and Mr I. W. Smith have been appointed directors of the company.

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MEN and MATTERS

A Review of People and Events

by George A. Greenwood

THEY say that wonders never cease. My old friend and contemporary, Critic, of *The New Statesman*, who, as you will know, is otherwise Mr Kingsley Martin, seems to think so, too. He has just been telling us that about 36,000 plain plastic book covers have been sold in Canada, mostly to office girls who want to read 'Lady Chatterley's Lover' on the bus to work! This, at any rate, says Mr Martin, is according to a statement in the manufacturers' survey. But the manufacturers say, too, that the covers are also being used by readers of religious books, who, for some reason or other, are reluctant to display the title in public. So you pay your money and you hide your choice, whether you are reading 'Lolita' or cramming for IRI or PI exams.

Not So Fusty

The conventional picture of a scientist as a fusty, absent-minded old man who is always losing his spectacles on his forehead, or as a stern heartless young man with no emotions outside a test tube, may not be so common these days, but it would disappear altogether if everyone could meet Madame Lamm. She is attractive, charming, and certainly not heartless. At the Paris conference (p. 931) not only did she deliver a highly competent paper on fluorinated elastomers, but she also gave an off-the-cuff translation of a paper given in English by Mr Ceresa. And she distinguished herself further by leaving the rostrum once to rectify the projector, which was throwing diagrams on the screen in every position but the correct one. And, as any lecture addict would agree, this could have been by far the most difficult task of the three.

Mme G. LAMM

The Tyre War

I hear that there are some important developments taking place in the tyre war to which I was referring a week or two ago, but in this case more especially on the waste side. This branch of the trade, as represented by the acting members of the Waste Rubber and Plastics Merchanting Association of Great Britain, in conjunction with the International Waste Rubber and Plastics Merchants' Association, are now organized to do what they can to fight a system which, they say, exists and threatens to create a monopoly in dealing with scrap, but more especially reusable tyres. They say, too, that this applies both to home and export accounts. There is now a suggestion that the issue shall be brought to the attention of the Monopolies Commission.

Under-floor Heating

All over inner and outer London vast commercial and domestic building projects are still in course of erection. In the building of big multi-story blocks of maisonettes for the LCC in Stepney, for instance, a feature being incorporated, I am told, is a special form of expanded polystyrene—Marleycel sound board—supplied by the Marley Tile Company and used in this case in conjunction with under-floor heating.

This is the first time that Marleycel sound board has been used in such a large-scale building application. It is a specially flexibilized form of expanded polystyrene, made by Shell at their chemical plant at Carrington near Manchester.

The technique for laying the boards of Marleycel and the under-floor coil heating system is extremely simple: the boards are cut to shape to fit the floor area, are laid in position and taped together. At the same time, 3in. strip is laid around the floor perimeter as a safeguard against heat and sound penetration into walls. The heating coil system is then placed on top of the Marleycel sound board and finally a 2in. thick floating concrete screed is put down on top of the coils. At a later stage $\frac{1}{8}$in. thick floating concrete screed is put down on top of the coils, and afterwards $\frac{1}{8}$in. thermoplastic tiles will be laid and the coils will keep the rooms at the required temperature.

The Honours List

There was nothing very spectacular, most people think, about the Queen's Birthday Honours List, but at least three entries are interesting for us. Field-Marshal Sir William Slim, who, only a few weeks ago joined the board of I.C.I., is the only viscount in the List. He has gone into finance and commerce in a big way since he ceased to be Governor-General of Australia last February. His other directorships include seats on the board of the London Assurance Co., Dalgety and Co., and the London Board of Advice of the National Bank of Australasia.

Among the new knights is Mr William McFadzean, whom we all know as chairman of British Insulated Callender's Cables, but who is cited in the List as president of the Federation of British Industries, on account of which his knighthood is bestowed.

Another knight less directly concerned with practical industry, but who is known to many concerns in rubber, plastics and chemicals, is Mr Richard Hugh Jessel, for some years until recently deputy chairman of the

Dunlop main board director, D. B. Collett, looks at part of an exhibition of rubber technology which he recently presented to the Loughborough College of Technology on behalf of the company. With him in the photograph are Sir Robert Martin, chairman of Leicestershire County Council and H. W. Haslegrave

Export Credits Advisory Council. He had a hand, and a big one, over those years, in determining the fate of a good many applications for financial assistance.

Development Director

Dr R. J. Wolf is the new director of development for B. F. Goodrich Chemical Company. He succeeds Anton Vittone, Jun., who has been promoted to general manager of plants. Dr Wolf will be responsible for all operations of the firm's development centre at Avon Lake, Ohio. He joined B. F. Goodrich Chemical Company in 1946 and held various positions in Geon vinyl resin development until his appointment as development superintendent of the firm's products application laboratory in 1952. He is a member of the American Chemical Society and the American Institute of Chemical Engineers.

Dr R. J. WOLF

Eastern Shop Window

'Very good stuff,' said Mr K. when he visited the I.C.I. Plastics exhibition which finished in Moscow yesterday. His visit put the seal of success on this enterprising piece of showmanship. Britain has been accused occasionally of falling behind in international publicity, but from all accounts the 2,700 exhibits put a very good shop window in the centre of Eastern Europe, and did an excellent job for I.C.I. and for the British plastics industry as a whole.

The exhibits, which appear in Leningrad next month, include the latest model of a baby car (with a variety of components made of plastics); a motorboat; toys and household goods; and items illustrating the production of pressure-cast articles and tubes.

Packaging Expert

Commercial Plastics have appointed H. M. Eve assistant managing director of their subsidiary, Anglo-American Plastics Ltd. This appointment has been made, I understand, in pursuance of the company's policy of expansion in the packaging field. It is extending its sales activity in order to be able to offer a more personal and direct technical/sales service for the use of plastic films for packaging. Mr Eve was a director and general manager of Industrial Tapes Ltd. He was with this company for 16 years, during which time he has gained a wealth of experience about packaging.

H. M. EVE

Some Personnel Changes

Some recent changes in the personnel of the Shell Chemical Co. on the plastics side have been announced. Mr L. G. J. Engle, manager of the southern sales region at Villiers House, in the Strand, has retired after 38 years with the company, and is succeeded by Mr M. D. Creed as regional manager. Mr Creed joined the Shell Group in 1938 and after war service as a major in the Royal Tank Regiment returned to Shell Petroleum Company. He transferred to the chemical side of the group's activities in 1948. In 1954 he was appointed chemical sales manager in the London area. Following expansion of the company's business he became the regional sales manager for solvents and resins, a post he has held since 1957.

From the board rooms comes the news that Mr Charles A. C. Bowen has been appointed a director of Dalkeith (Ceylon) Rubber Estates in place of the late Captain J. P. Farquharson, and that the board of BTR Industries Ltd. have unanimously elected Sir Walter Worboys as chairman in succession to Sir Graham Hayman. He has resigned owing to pressure of other work but is retaining his seat on the board.

* * *

M. S. Welling, who has been Press officer of British Geon for the past six years, has been appointed sales promotion officer of Bonded Fibre Fabric Ltd., a Courtaulds subsidiary.

Question Corner—122

(Second Series)

447. How are extruders adapted for bottle blowing?

(Answer next week)

Answer to Question Corner—121

446. Blocking is a problem sometimes encountered with polythene film when it is rolled up or made into bags, or when it is stacked under moderate pressure during storage. In these conditions sticking often occurs. Its inability to slide one film over another is usually the result of poor slip, or a high coefficient of friction of the film.

One of the causes is too much tension in winding up the film on extrusion. This can be further aggravated by insufficient cooling of the film before it is wound up, and is particularly the case when running at high speeds. This may be reduced by low-tension wind-up, by slower wind-up rates, by increasing the distance between the die and the pinch rolls and by using a minimum pinch roll pressure in blown film extrusion.

Surface blocking is a problem in blown film extrusion. The inflated bubble travels at high speed and, being cooled only with air, is squeezed together and wound only a few seconds after leaving the hot die. Blocking may occur on the inside of the tube.

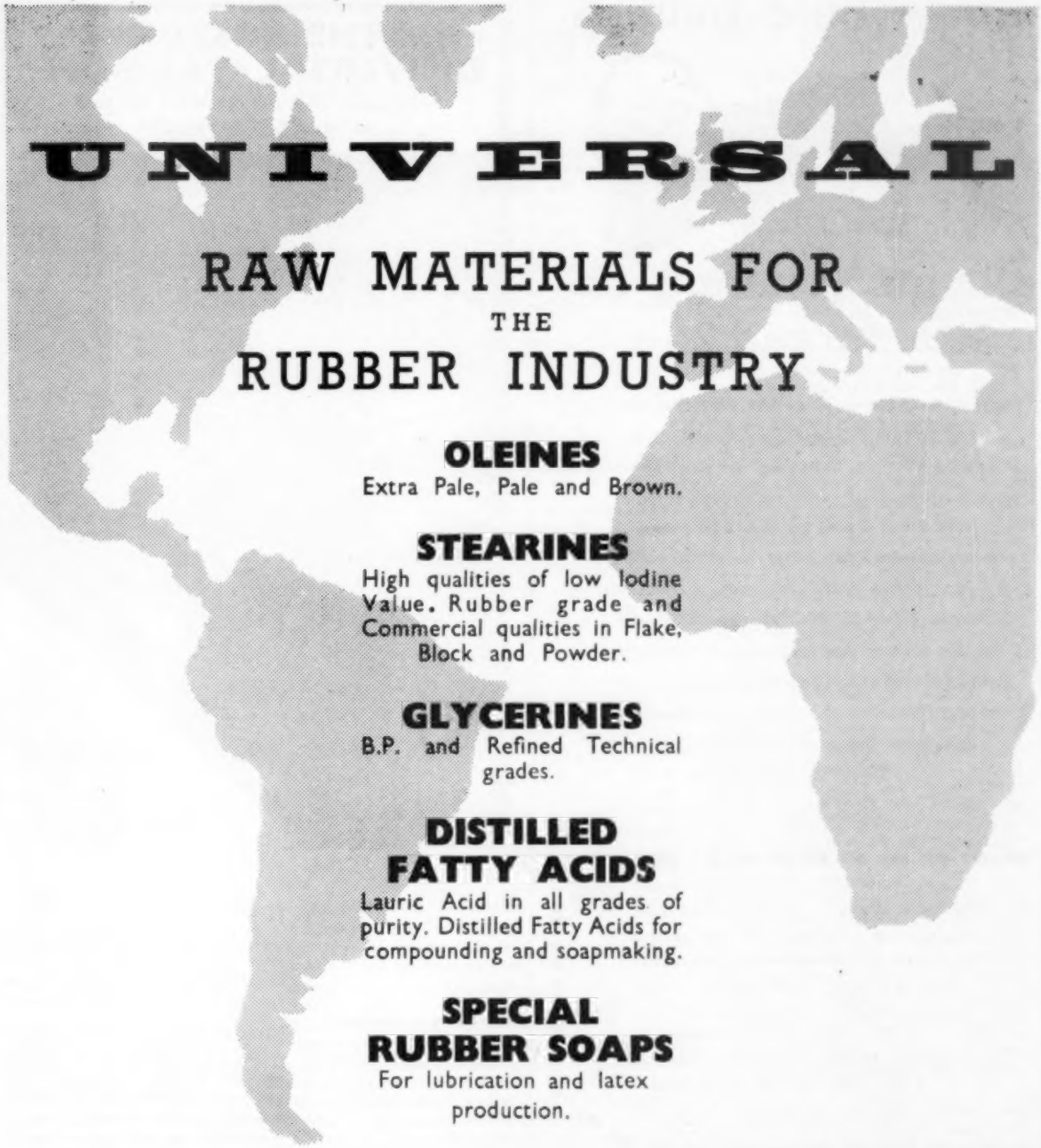
Thicker films tend to stick less than thin ones and, generally, lower melt index resins require less anti-blocking additives than higher melt index resins.

Film surface treatments used for ink adhesion frequently cause blocking—because they alter the surface condition and warm the film. The anti-blocking agents are also frequently driven off by such treatment.

(Another question next week)

Polly Ester Says . . .

'Ageing Resistance? That's the number of years subtracted each birthday'



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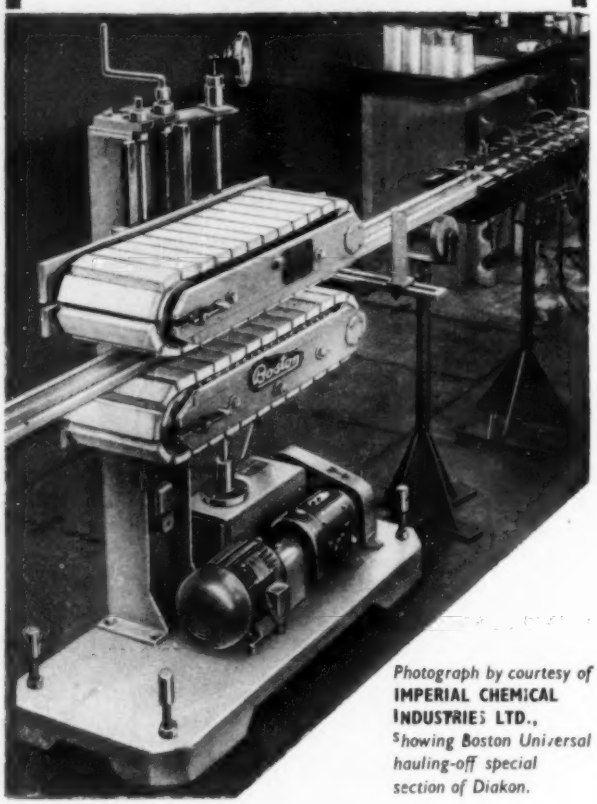

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Plantation Commentary

DRIFTING APART OF MALAYA AND SINGAPORE

by our Malayan Correspondent

FROM KUALA LUMPUR

THREE major changes are being made or are planned in organizations concerned with the rubber industry, two of them connected with the fact that the Federation of Malaya as an independent country is increasingly striking out on its own. The causeway between Malaya and Singapore is still an umbilical cord as far as the great proportion of trade is concerned, but in other ways Malaya, with its right-wing Government, is drifting away from the socialist Singapore.

For example, the University of Malaya division in Kuala Lumpur is to be launched soon as a separate entity, Malaya is in many ways in competition with Singapore on industrialization, Port Swettenham is being more than doubled in size as a port and Malaya is planning an international airport which will be at least as large as Singapore's Paya Lebar, if not larger, and in other ways Malaya is setting up shop on its own.

The Rubber Association of Singapore and Malaya is a little unusual in being both pan-Malayan (including Singapore and Malaya) as well as all-racial. The new body was sponsored by the Rubber Trade Association of Singapore, the Rubber Trade Association of Malaya and the Singapore Chamber of Commerce Rubber Association. It is intended that it should speak with one voice in both territories for its members—estate selling agents, brokers, manufacturers, buying agents and dealers.

This is the first time that this has been possible on a pan-Malayan basis and marks an historic step forward.

The new organization was established in Singapore after two years of negotiation. All categories of members have equal voting rights and will eventually take over the responsibility of the clearing house which at present rests with the Singapore Chamber of Commerce Rubber Association. The clearing house last year handled payments on fob tenders totalling $460m.

At the inaugural meeting, a well-known Chinese businessman, Tan Lark Sye, was elected chairman and a rubber broker, E. G. Holliday, was elected deputy chairman. A chartered accountant, C. W. Tresise, was elected permanent vice-chairman, and will be a full-time executive officer, a new departure in Malaya and Singapore which follows the organization of the London Rubber Trade Association. He will be responsible for the running of the day-to-day affairs of the association. Committee members are Ko Teck Kin, Ng Quee Lam and Heah Joo Seang.

It is hoped that the association will be able to play its part in improving Malayan trading conditions and promote, support or oppose legislative or other measures affecting the industry. The association will provide means of facilitating business and the transactions of the rubber trade.

Other objects are to set up forms of contract between members as well as between members and others; to regulate business transactions, rights, duties, obligations and the liabilities of members in connexion with the trade as well as undertake arbitration between members; prepare, publish and circulate market and shipping reports and records of the rubber trade; inspect samples and trade rubber in any part of the world.

Call in the Afternoon

In Kuala Lumpur, the capital of Malaya, in co-operation with the Singapore share market, Malayan share brokers are now holding a daily afternoon 'call' which is the first step to setting up a Malayan stock exchange. It is early yet for a more formal arrangement, but interest and business has been better than many expected and a full-blown stock exchange separate from Singapore may transpire earlier than initially seemed possible (*RJIP* March 26, 462).

The move by Malayan sharebrokers has the interest of the Malayan Government and the brokers are, in fact, using premises in the Central Bank that have been made available.

The Malayan Ministry of Commerce has also announced the formation of a committee which is to consider the establishment of a rubber exchange in Malaya which will be additional to the exchange in Singapore. The committee is to examine the form of marketing organization and most suitable legislation. There will be two official members and 11 unofficials, under the chairmanship of the secretary to the Ministry, Mr I. D. Irvine.

The unofficial members are Inche Mahmud Sheik Abdul Majid, Mr Lim Yee Teck, Mr Gan Teck Yeow, Mr H. B. Hussey, Mr J. Brown, Mr E. C. Tokeley, Mr E. G. Holliday, Mr J. E. Cogswell, Mr Tan Puay Hee, Mr T. E. Atkinson and Mr Cheah Ewe Keat.

The formation of a rubber exchange in Malaya has been in the air for some time and the Government has promised all help in getting it started, in the provision of suitable legislation, though it will not interfere in the running of the exchange.

The Last Incident

Many rubber planters in Malaya were jolted back through the years when a news item in the paper announced that a Communist terrorist had been shot dead on an estate.

But it was not a return to 1950-51. The Triang area, where the killing occurred, has been blessed with six stubborn and fairly inoffensive Communists who have resisted all blandishments to come out of the jungle and are apparently living on oil palm nuts. A British Army captain, on leave and hunting wild game, saw some figures around an old palm on an estate. The next thing was that a shot was fired at him. He shot back and the next morning police found the dead body of a 'hard-core' terrorist and signs that another had been wounded.

This may well be the last 'estate incident' of the emergency. It began on June 18 1948, after the shooting of three British planters on estates in Perak by the Malayan Communist Party and ends on July 31 this year after costing 11,000 lives including the death of 99 planters. The cost is conservatively estimated at $1,750m. but the total cost can never be counted.

There remain between 300 and 400 terrorists straddling the border with Thailand and it seems likely that while the general regulations will be removed there will be special regulations for these areas of conflict. The terrorists here are particularly hard to run down as they appear to be able to rest and feed in Thailand without much difficulty; even so they are not particularly aggressive and efforts are being made to co-ordinate operations in the area between Malayan and Thai troops.

The emphasis has now changed from the shooting war to subversion and the Malayan Government is well aware of the underground menace that exists. There is little danger in the repeal of the Emergency Regulations resulting in another wave of Communist-inspired strikes backed by intimidation and force which reached a crescendo before June 18 1948.

Amendments to the Constitution passed by Parliament will allow the Government to introduce legislation providing for compulsory detention for those indulging in subversive tactics. The opposition attacked this proposal strongly in Parliament but without success, and in view of the Communist Party's known intention to get its way by subversion, including the infiltration of trade unions, there seems little else that could be done.

The Government appears to have adequate powers to deal with any problems that may arise after the Emergency Regulations have been swept away.

Pioneer Questions

A series of questions on pioneer industries in Malaya, mostly related to

the application by Dunlop Rubber Co. for pioneer status for a tyre factory, were asked in Parliament by opposition M.P.s Pioneer status provides tax concessions and certain other advantages for a new industry starting up in Malaya.

The Minister of Commerce and Industry, Inche Mohd. Khir Johari, said that no pioneer certificate had been issued yet for making tyres and tubes. The application from Dunlop had been approved in principle subject to the Government agreeing on the amount of tariff protection required. But he made it clear that the certificate had not been actually granted yet.

'None of the other applications for pioneer status to make tyres and tubes has been refused,' he said.

The Minister said that he was not aware of any public resentment against the Dunlop application. The application for tariff concessions by the company was being considered by the Tariff Advisory Committee and the committee's report was under consideration. Inche Mohd. Khir said that the Dunlop application was submitted on May 8 1959 and was the first in the country for tyres and tubes.

All of the other applications had some foreign element in them.

Dealing more generally with the question of giving help to foreign companies setting up business in Malaya, the Minister said that no special steps were being taken to encourage local investment. Local investors, manufacturers and businessmen had taken advantage of the help given in general to industry and this was shown by the fact that pioneer certificates had gone to 15 wholly-owned local firms, four in which local participation was more than 50% and five in which local participation was less than 50%.

The Government encouraged the purchase of local rather than foreign (made outside Malaya) products. The Minister told another questioner that pioneer industries were expected to obey ordinary labour regulations and there were no special regulations governing them. But conditions were imposed in granting pioneer certificates covering the number of Malayans and foreigners employed. The conditions were dependent on the firm and the Ministry agreeing on the need for skills being provided by technical and managerial people from outside Malaya.

Book Review

ENGINEERING DESIGN WITH RUBBER.—By A. R. Payne and J. R. Scott. Pp. IX + 255. (London: Maclaren and Sons Ltd.; New York: Interscience Publishers, Inc.)

Although rubber has already established itself as an important material for use in engineering applications there is still a widespread lack of appreciation and understanding of its characteristic properties. This deficiency, which effectively restricts its wider use as a general engineering material, stems from two distinct sources. The first appears to be associated with differences in the basic training of rubber technologists and design engineers; as a result they often have different approaches to common problems, and sometimes they do not even speak the same language. The second reflects ignorance of the basic principles governing the behaviour and life of rubber components in service and demands the development of a fuller and sounder knowledge of the properties determining their behaviour.

This volume is the most recent of a number of attempts to remedy some of these deficiencies which have been made during the last fifteen years. It provides a record of material presented at Symposia organized by the Research Association of British Rubber Manufacturers in October and December 1958. These were attended by rubber technologists and engineers from both within and without the rubber industry, and their purpose was essentially to assist in developing the use of rubber in engineering applications to a fuller extent and to better advantage.

Reports of Symposia are usually disconnected and unbalanced with regard to both the nature of the various topics discussed and their methods of presentation. In this instance the authors have made a real endeavour to overcome this undesirable feature and sufficient extra material has been introduced to enable the book to be presented as a coherent manual on engineering design with rubber.

The book can conveniently be considered in three parts. The first includes a description of the basic properties of rubber relevant to its use as an engineering material. It provides a short review of current ideas on the source of the unique elastic properties of rubber. This is followed by a more detailed discussion of the so-called 'dynamic properties' of rubber. Here the first serious hurdle is immediately apparent. Rubber technologists are not yet able to characterize and evaluate the dynamic elastic properties of rubber in a simple unifying way, and at present design engineers will have to be content with little more than guiding principles. There is, however, a ray of hope that this position may shortly be improved; recent advances in describing the time and temperature dependence of the elastic properties of rubber have an encouraging simplicity.

The next part describes in detail a wide variety of test methods which have been used to measure dynamic properties. The absence of any critical assessment of the relative value of different methods will disappoint design engineers, but it again reflects that the measurement of dynamic properties is still in a research stage. This part also contains a useful section on the properties which rubber technologists conventionally use to characterize their materials.

The last part of the book is easily the most satisfying. It deals in some detail with methods for determining relations between load and deformation. Recent developments in the field of rubber physics now permit the engineer to determine the 'static' behaviour of actual pieces of rubber for a wide variety of applications at the drawing board stage. This is a notable advance and apart from obviating the need for a completely empirical approach to the design of rubber units should result in a more intelligent and more satisfactory use of rubber.

The final chapters bring together a number of useful points in the practical design of rubber units, notably some aspects of design concerned with avoiding excessive local stresses and the use of metal inserts to modify stiffness. A description of a few typical applications shows that estimates of the dimensions and performance of simple rubber components may be reached without recourse to specialized experience and with the use of surprisingly few physical constants and relations. The applications considered include the use of rubber pads to support railway tracks, rubber mountings for pile driving hammers, and rubber bearings in the mounting of bridges.

It is to be hoped that this book will be widely read both by rubber technologists and design engineers alike. They will find much that is of interest, and if it does no more than familiarize them with each others' problems it will have performed a valuable purpose. The publishers are to be congratulated on the excellent production of the book.—L. MULLINS.

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

Modern Chemical Specialties

Foster D. Snell Inc., 40-year-old New York firm of chemical consultants, has announced the availability of a new booklet, Modern Chemical Specialties. The booklet attempts to outline the scope of the specialties field, and offers a number of brief 'case-histories' of successful Snell developments in the chemical specialties field. Copies of Modern Chemical Specialties are available from 29 West 15th Street, New York 11, New York, USA.

Dr Anthony Michaelis is joining Ciba Laboratories as director of information on August 1.

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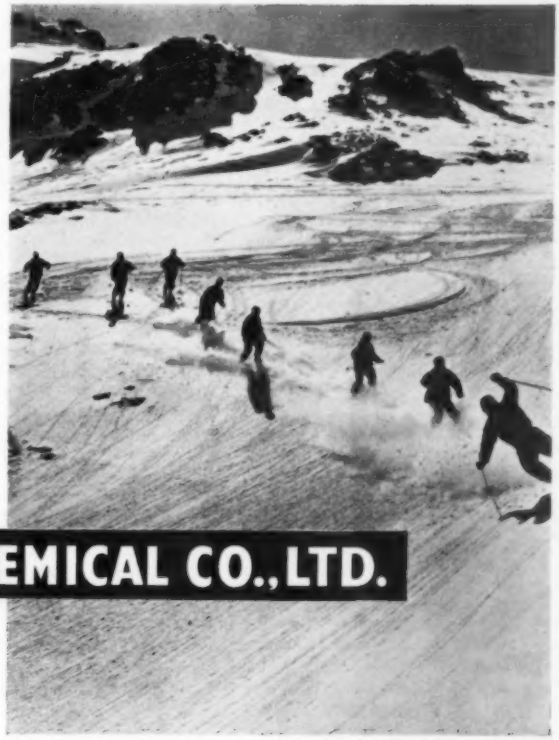

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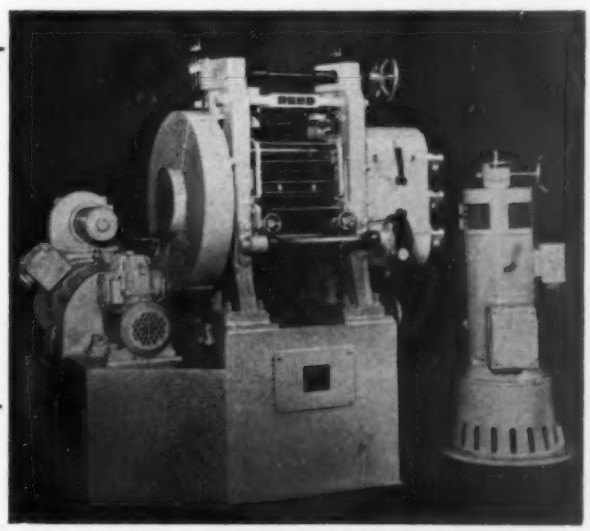

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Rubber Statistics

WORLD POSITION AT THE END OF MARCH

THE Secretariat of the International Rubber Study Group has now released preliminary details of the world rubber position as at the end of March last. The following table shows the natural rubber production and consumption totals for the first quarter of the year, and compares them with those for the first quarter of 1959 (in 1,000 long tons):

NATURAL RUBBER

	Jan./March 1960	Jan./March 1960	Jan./March 1959
Production:	157.5	477.5	465.0
Consumption:	157.5	510.0	520.0
		Change since Jan. 1 1960	
Stocks at March 31:			
In producing areas ..		247.5 – 7.5	
In consuming areas ..		227.5 + 30.0	
Afloat		205.0 – 25.0	
		680.0 – 2.5	

The Study Group states that the March consumption total includes estimated imports into Russia of 3,250 tons and into China of 4,000 tons. Imports for the first quarter into these two countries totalled respectively 23,750 tons and 49,500 tons, or 73,250 tons in all, compared with the 1959 imports for the first quarter of 39,500 tons and 35,500 tons respectively, or 75,000 tons in all; they thus represented nearly 15% of all rubber consumed during this period.

Synthetic Rubber

The synthetic rubber position is set out in the following table:

SYNTHETIC RUBBER

	Jan./March 1960	Jan./March 1960	Jan./March 1959
Production:	165.0	490.0	380.0
Consumption:	152.5	440.0	380.0
		Change since Jan. 1 1960	
Stocks at March 31:		327.5 + 17.5	

The considerable increase, both in production and consumption, compared with last year, is clear from the above table, as is also the fact that production continues to outpace consumption very slightly, the balance going to build up stocks which, at the end of March, stood some 72,500 tons higher than at the same time last year.

US General Position

The US Department of Commerce has now issued the following preliminary statistics for the month of April (in long tons):

NATURAL RUBBER

Consumption:
42,032 tons of which latex 4,199 tons
Stocks:
83,451 tons of which latex 13,896 tons

SYNTHETIC RUBBER

	Production	Consumption	Stocks
S-Type ..	97,963	75,849	185,464
Butyl ..	7,958	5,492	14,021
Neoprene ..	11,879	6,525	13,796
N-Type ..	3,095	2,386	8,230
	120,895	90,252	221,511

Total new rubber consumption during April amounted to 132,284 tons, compared with 144,932 tons in March, bringing the total for the first four months of the year to 557,928 tons, compared with last year's figure of 542,589 tons. Of the April total, natural rubber accounted for 31.77% compared with 32.60% in March.

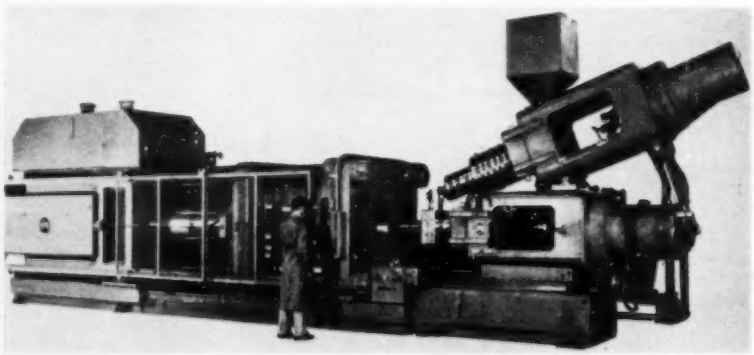
Sole Crepe

Exports of sole crepe from Malaya during March totalled 895 tons, compared with 848 tons in February, bringing the total for the first quarter of the year to 2,628 tons. The United Kingdom was the principal customer, taking 369 tons, and was followed by Spain with 220 tons. Other countries taking this sole crepe included France (76 tons) and Western Germany (38 tons).

Ceylon's exports of sole crepe in March totalled only 47 tons, 26 tons of which went to France, while Vietnam sent 6 tons to France; Cambodia did not export any sole crepe during this month.

Large Capacity Moulder

CRAVENS Ltd. are now producing the HPM 1500-P-300 injection moulding machine with preplasticizer in their works at Sheffield. The machine is all-hydraulic, thereby providing fast and simple setting up.



The injection pressure and rate of injection are both high thus making easier the moulding of the more sensitive materials such as ABS, acrylics and polycarbonates. The preplasticizer, which may be semi or fully automatic in operation, has five zone heating and has been specially designed to give extremely accurate control of shot weight, and the daylight and stroke dimensions are such that very large products may be moulded.

The pyrometers, relays and other main electrical controls are housed in a separate cabinet which may be situated well away from the machine.

A few figures from the machine specification are as follows: Shot capacity 300oz. clamp pressure 1,500 US tons. Plasticizing capacity up to 400lb./hour, depending on the material. Rate of injection 3,600 cu. in./min. Maximum mould space (horizontal and vertical) 48in. x 72in. Mould opening stroke 60in. Maximum daylight opening 106in. Maximum mould separating pressure 90 tons. Floor space required approximately 36ft. x 12ft. Height 11ft. 6in. Shipping weight 215,000lb.

Vinyl for Chemical Plant

Development of a homogenous extruded rigid Koroseal vinyl sheet 50in. wide and ranging in thickness from .060 to .125in., for use in fabricating chemical plant equipment, is announced by B. F. Goodrich Industrial Products Company. The material is stocked in normal and high-impact sheets.

The Chemical Division of The Goodyear Tyre and Rubber Co. (G.B.) Ltd., announce the appointment of Mrs Barbara Jones as administrative assistant to the manager. Mrs Jones, previously in Industrial Products Development, joined Goodyear in 1947.

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Ethylene-Propylene Copolymers

No. 831,989. Esso Research and Engineering Co. Application and Filed, January 17 1957. Application in USA, January 31 1956. Published, April 6 1960.

Ethylene in a proportion of 93.0 to 99.5 mol. % is copolymerized with propylene in a corresponding proportion of 7.0 to 0.5 mol. % in the presence of a catalyst obtained by mixing reducing compound of aluminium with a reducible compound of a metal of Groups IVA, VA, VIA and VIII of the periodic table, in the presence of an inert diluent, at temperatures of 0° to 90°C. and pressures of 1 to 10 atmospheres.

The copolymers are more flexible than polythene and possess also the following properties: high softening and high melting points, high tensile strength and good elongation. They are particularly useful in the manufacture of pipes, coating, wire insulation and film.

Continuous Vulcanizing Machine

No. 832,126. American Biltrite Rubber Co. Inventor: J. M. Bierer. Application and Filed, December 12 1957. Published, April 6 1960.

In continuous vulcanizing machines of the 'Rotocure' type as hitherto constructed, the unvulcanized rubber sheet has been introduced at the bite of the pressure band and drum as determined by one of the guide rolls. With material of certain compositions, it has been found that if the sheet is subjected to substantial pressure at the bite there is a tendency for the material to roll back and form a wave at the point of entry. According to the invention, this tendency is prevented by reducing the pressure of the band at the point of entry of the unvulcanized rubber sheet and providing an additional pressure-applying roll operating to apply full pressure to the sheet only after it has been confined between the drum and the band for a sufficient distance to eliminate all tendency to roll back the rubber.

Copolymers

No. 832,207. Farbwerke Hoechst AG. Application and Filed, April 23 1956. Application in Germany, April 21 1955. Published, April 6 1960.

Copolymers of ethylene or propylene and styrene are made by the Ziegler low-pressure polymerization process as described in Specifications Nos. 799,392, 799,823 and 801,031. Instead of styrene, a substituted styrene may be used, such as chlorostyrene. The copolymers of the invention exhibit a lower tendency to crystallize and to become brittle when stored at an elevated temperature than polythene or polypropylene. For example, film of an ethylene-styrene copolymer did not become brittle after storage at 120°C. for 17 days. The process may be applied to the preparation of polymers of more than two components, *e.g.*, a terpolymer of ethylene, propylene and styrene.

Shorter Abstracts

Chair. 827,816. J. W. Follows. Filed, April 8 1958.—A chair comprises a rigid frame over the whole of which, apart from the legs, is moulded a covering of polyurethane foam as a single moulding.

Polymeric Compositions. 826,483. Petrochemicals Ltd. Filed, May 28 1957. Isotactic polystyrene is blended with either an elastomer or a low pressure polythene. Such blends are less brittle than isotactic polystyrene alone.

Linear Polyamides. 825,096. British Nylon Spinners Ltd. Filed, March 7 1958. — New synthetic linear polyamides of high molecular weight are obtained by appropriate treatment of a durene derivative of a specified type.

Polythene Coatings. 823,175. Metallgesellschaft AG. Filed, October 10 1957.—The adhesion of polythene coatings to metals of all kinds is improved by interposing a film of a polyamide between the metal and the polythene coating.

Compounding Rubber. 824,252. Dunlop Rubber Co. Ltd. Filed, June 12 1956. Addition to 686,757. — A thermosetting resin is incorporated in rubber by mixing the resin into an aqueous dispersion of the rubber and co-coagulating the mixture. Suitable resins are urea-aldehyde, phenol-aldehyde and aniline-formaldehyde. After co-coagulation, the mixture is mechanically worked whereby the resin is hardened.

Antioxidants. 825,630. The B. F. Goodrich Co. Filed, February 15 1956. — Ortho alkylated bis-phenol saturated cyclic ketones are claimed as non-staining, non-discolouring deterioration retarders for natural and synthetic rubbers.

Rubber Sheet. 830,104. N. V. Rubatex. Filed, March 19 1958.—Rubber sheet is prepared directly from natural or synthetic latex by passing the latex between two belts each covered with a layer of coagulant. A relatively thick latex sheet of high wet-gel strength can be produced by the process.

Rubber Crop Returns

Unless otherwise indicated the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

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April

London Asiatic.—1,294 (1,253). 4 mths—5,975 (5,559).
Oriental.—218 (215). 4 mths—987 (894).
Bukit Kajang.—97. 4 mths—420.
Lanadron.—345 (348). 4 mths—1,551 (1,509).
Pataling.—1,098 (1,060). 6 mths—7,723 (6,816).
Jugra Land & Carey.—292 (396). 6 mths—2,686 (2,729).
Golden Hope.—600 (616). 2 mths—1,251 (1,249).
New Crocodile.—181 (198). 2 mths—390 (397).
Castlefield.—233 (229). 10 mths—2,641 (2,345).
Holyrood.—71 (67). 4 mths—326 (268).
Hongkong.—27 (22). 4 mths—115 (102).
Hoscote.—215 (203). 10 mths—2,374 (2,386).
Killinghall.—36 (39). 10 mths—426 (432).
Kuala Selangor.—55 (51). 4 mths—243 (220).
Kulai.—166 (194). 6 mths—1,034 (1,202).
Malaysia.—49 (47). 4 mths—222 (189).
Prang Besar.—281 (211). 1 mth—281 (211).
Sandac.—65 (45). 1 mth—65 (45).
Seaport.—60 (66). 10 mths—714 (764).
Malayalam.—941 (746). 1 mth—941 (746).
Lunuva.—75 (75). 4 mths—392 (393).
Allied Sumatra.—636 (565). 4 mths—2,875 (2,822).
Asahan.—73 (79). 9 mths—862 (1,058).
Bah Lias.—132 (101). 6 mths—915 (906).
Central Sumatra.—64 (60). 10 mths—707 (876).
Lankat Rubber.—59 (53). 1 mth—59 (53).
Mendaris.—128 (123). 4 mths—637 (675).
Namoe Tongan.—195 (139). 8 mths—1,904 (1,850).
Sialang.—178 (163). 3 mths—561 (549).
Soengei Rampah.—41 (39). 4 mths—174 (188).
Tanah Datar.—53 (53). 4 mths—246 (260).
Tandjong.—110 (126). 10 mths—1,524 (1,492).
Toerangie.—150 (143). 6 mths—1,160 (1,173).
United Lankat.—26 (23). 4 mths—121 (106).
United Serdang.—767 (637). 8 mths—6,999 (7,056).

THOMAS BARLOW

April

Bradwall.—115. 4 mths—511 (427).
Chersonese.—52. 4 mths—252 (206).
Highlands & Lowlands Para.—1,581. 4 mths—7,138 (6,886).
Krian.—5. 4 mths—21 (24).
Sungei Krian.—131. 4 mths—623 (562).
Muar River.—315 (329).

SHARPE ESTALL

April

Anglo Johore.—26 (27). 9 mths—308 (299).
Bekoh CRE.—159 (165). 1 mth—159 (165).
KPRP.—45 (51). 1 mth—45 (51).
Rim (Malacca) RE.—188 (176). 10 mths—2,238 (2,166).
Kurunegala.—20 (18). 4 mths—96 (88).

Rubber and Plastics Stock Market

A REVIEW OF PRICES AND TRENDS

THE good old times have certainly made a come-back in stock markets. Since we last had the pleasure share prices have continued to make progress. Some performances could even be described as sparkling and because of this we have decided to spotlight the features in the following table:

Greeff	47s. 6d.	+	10s. 9d.
English China Clays	90s. 6d.	+	12s. 6d.
Xylonite ...	103s. 9d.	+	8s. 3d.
De La Rue ...	77s. 0d.	+	7s. 0d.
Bakelite	56s. 3d.	+	4s. 6d.
Distillers ...	39s. 0d.	+	3s. 3d.
Courtaulds ..	70s. 7½d.	+	4s. 7½d.
B.I. Plastics .	10s. 4½d.	+	3s. 6d.

Some of these movements have been connected with particular company news items, a factor which has again proved to have been the most stimulating in keeping investment interest alive. For there has been no real increase in the volume of business that has passed through broker hands. At present, however, it takes little buying to push prices higher. The current share famine plus the good recovery made by Wall Street suggests that the upward trend will continue.

Excellent results were produced by the COURTAULDS giant, who reported that group net profits had gone up from £7.29m. to £11.87m. In addition to the bigger dividend—2s. 6d. against the previous 1s. 11.2d.—shareholders are also to receive a one-for-three share bonus. What is more the board disclosed that business remains active in nearly all parts of the group and they could see no indication at present that the current year's results will differ materially from those for the year 1959-60. At the forthcoming annual meeting Sir John Hanbury-Williams will supplement the information provided in the report in the light of events which have taken place since the end of the financial year.

From DE LA RUE came news that turnover had increased from £13,858,000 to £17,056,000. The dividend here went up by 3d. to 2s. 3d. per 10s. ordinary. In addition there was a share bonus on a one-for-four basis. Provided no unforseen circumstances arise the board expects to be able to recommend for the current year a dividend on the ordinary as increased by the scrip issue at rates not less than those for the past financial year. Group trading profits worked out at £2,282,400 against last time's £1,586,700.

In view of reports and whispers of possible takeover offers of B.I. PLASTICS with another substantial concern—most popular candidate, BRITISH OXYGEN—the directors decided to issue a statement. They admitted that approaches had been made with a view to a merger by more than one substantial company. They said that nego-

Continued on page 950

Share Price Movements

Par Value	Company	1960 High	Low	June 4	Latest
£1	A.E. Ind. Ord.	67/-	50/3	57/3	58/-
5/-	Albright & W. Ord. ..	31/9	25/9	29/3	30/3
£1	,, ,, ,, 5% Pref.	17/3	16/-	16/9	16/6
5/-	Anchor Chemical Ord.. .	18/7½	14/9	15/-	15/3
5/-	Andersons Rub. Ord. ..	—	—	3/1½	3/1½
£1	Angus Geo. Ord. ..	47/6	34/9	46/6	46/9
5/-	Ault & Wiborg Ord. ..	25/-	20/-	23/-	24/9
£1	Avon India Rubber Ord.	46/6	35/-	35/3	36/-
£1	,, ,, ,, 6% Pref.	20/-	17/6	18/9	18/9
10/-	Bakelite Ord.	56/3	39/9	51/9	56/3
£1	,, 6% Pref. ..	19/-	16/9	19/-	19/-
£1	Baker Perkins Ord. ..	54/-	49/9	51/6	52/3
4/-	Bank Bdg. Rubber Ord.	3/9	2/3	3/-	2/3
4/-	Brammer H. Ord. ..	18/3	16/9	17/9	18/3
10/-	Bridge, David Ord. ..	60/-	53/6	59/6	59/-
5/-	Bright, John Ord. ..	18/6	15/3	16/6	17/4½
2/-	Brit. Ind. Plas. Ord. ..	10/6	5/3	6/10½	10/4½
2/-	,, 10% (tax free) Pref.	4/9	4/3	4/9	4/9
£1	British Xylonite Ord. ..	103/9	78/9	95/6	103/9
£1	,, ,, 5% Pref.	17/6	15/-	16/9	16/9
£1	BICC Ord.	61/3	51/6	52/3	51/9
5/-	BTR Ind. Ord.	14/3	9/9	12/9	14/3
£1	,, ,, 7½% Pref. ..	24/3	23/-	23/9	23/6
£1	Courtaulds Ord. ..	70/7½	58/9	66/-	70/7½
£1	,, 5% 1st Pref.	17/9	16/3	16/6	16/6
£1	,, 6% 2nd Pref.	21/-	19/4½	19/6	19/4½
4/-	Cow, P. B. Ord. ..	9/-	6/9	8/9	9/-
£1	,, ,, 5% Pref. ..	15/6	14/9	15/-	15/-
1/-	Dannimac Mfg. Ord. ..	12/9	10/-	10/-	10/3
10/-	De La Rue Ord. ..	76/3	65/6	70/-	77/-
£1	,, ,, ,, 3½% Pref. ..	12/-	10/9	11/-	10/9
10/-	Distillers Co. Ord. ..	39/9	32/9	35/9	39/-
£1	,, ,, 6% Pref...	22/-	20/6	20/9	20/9
£100	,, 5% Conv. Loan	£96	£95½	£96	£96
£100	,, 5½% Unsec. Loan	£97	£89½	£90	£89½
10/-	Dunlop Rubber Ord. ..	28/3	21/9	27/9	27/9
£1	,, ,, 5½% Pref.	19/-	17/-	17/9	17/6
£100	,, 3½% 1st Debs.	£78	£74	£76	£75½
£100	,, 4½% 2nd Debs.	£87	£85½	£86	£85½
£1	Eng. Elect. Ord. ..	53/6	39/-	41/-	41/-
4/-	Ebonite Cont. Ord. ..	14/3	11/9	11/9	11/3
£1	English China Clays Ord.	95/-	74/6	78/-	90/6
£1	Goodyear Tyre 4% Pref.	12/9	11/6	11/9	11/9
5/-	Greeff Chem. Ord. ..	47/6	29/3	36/9	47/6
10/-	Greeff Chem. 5½% Pref.	9/-	8/6	8/9	9/-
5/-	Hackbridge Hldg. ..	17/6	14/9	16/3	16/-

Par Value	Company	1960 High	Low	June 4	Latest
4/-	Greengate & Irwell Ord.	6/6	5/3	5/3	5/4½
£1	Harrisons & Crosfield Dd.	64/-	51/3	52/-	51/9
1/-	Hunt & Moscrop Ord...	2/9	1/9	2/1½	2/-
£1	Imp. Chem. Ord. ..	63/3	56/6	60/1½	62/6
£1	,, ,, 5% Pref. ..	18/-	16/6	16/9	16/6
£100	,, 4½% Unsec. Loan	£89½	£84	£86	£84
£100	,, 5½% Conv. Loan	£196	£175	£195	£196
1/-	Kleemann (O. & M.) Ord.	10/3	8/3	9/6	10/3
£1	,, ,, 6½% Pref.	19/-	17/-	18/9	17/9
2/-	Lacrinoid Prod. Ord. ..	5/-	3/-	3/6	3/-
5/-	Laporte Ind. Ord. ..	32/-	25/3	28/9	30/3
£1	,, ,, 7½% Pref.	24/3	23/3	23/3	23/3
£1	Leyland & Birm. Rubber Ord.	57/-	46/3	46/3	52/6
£1	,, ,, ,, 6% Pref.	19/-	17/6	18/9	19/-
2/-	London Rubber.. ..	14/9	11/-	14/3	14/-
£1	,, 6% Red. Cum. Pref.	20/-	18/9	18/9	18/9
£1	McKechnie Bros. Ord...	71/6	57/6	63/-	57/6
£1	,, ,, 'A' Ord.	69/3	58/9	60/-	59/6
£1	,, ,, 6% Cum. Pref.	18/-	16/-	17/-	17/-
5/-	Monsanto Chem. Ord. ..	28/-	23/3	24/6	25/6
£1	,, ,, 3½% Pref.	12/9	12/3	12/6	12/1½
£100	,, ,, 6% Debs.	£103½	£100	£100½	£100
5/-	Miles (H.G.) Holdgs. Ord.	11/3	9/9	11/-	10/9
£1	North British Rubber ..	21/3	17/-	18/3	17/-
5/-	Plastic Enginrs. Ord. ..	25/-	20/-	24/-	24/6
5/-	Redfern Holdings Ord...	5/9	4/3	5/7½	5/4½
2/-	RFD Ltd. Ord.	6/6	5/-	5/6	5/1½
£1	,, ,, 5½% Pref. ..	14/6	12/9	13/9	13/9
2/-	Rubber Imp. Ord. ..	7/9	4/6	4/6	4/10½
2/-	,, ,, 'A' Ord. ..	7/-	3/3	3/3	3/9
£1	,, ,, 5% 1st Pref.	15/-	11/3	12/3	12/3
5/-	Rubber Reg. Ord. ..	19/3	17/-	17/6	17/9
4/-	Shaw Francis Ord. ..	27/6	21/3	21/3	22/9
2/-	Silentbloc Ord.	13/3	10/-	11/3	11/1½
5/-	Storey Bros.	36/-	28/3	33/-	34/-
2/-	Sussex Rubber Ord. ..	2/3	1/3	1/9	1/11½
5/-	Sutcliffe Speak Ord. ..	15/9	11/-	15/3	13/6
£1	Turner & Newall Ord. ..	115/-	100/-	100/9	103/3
£1	,, ,, ,, 7% Pref.	25/-	23/-	23/3	23/3
5/-	Universal Asbestos Ord.	43/9	32/6	43/6	43/9
5/-	Viscose Dev. Ord. ..	16/6	14/9	16/-	16/6
5/-	Warne William (Holdgs.) Ord.	18/6	17/-	17/-	17/6

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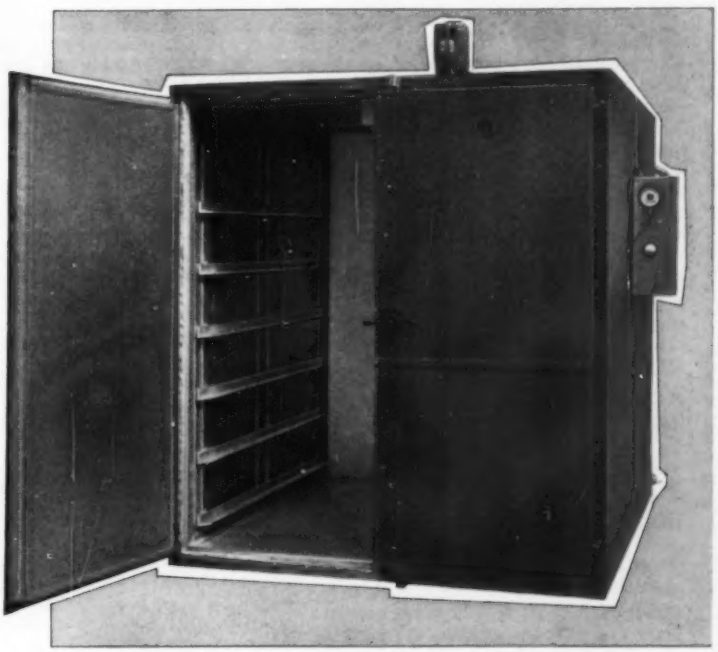

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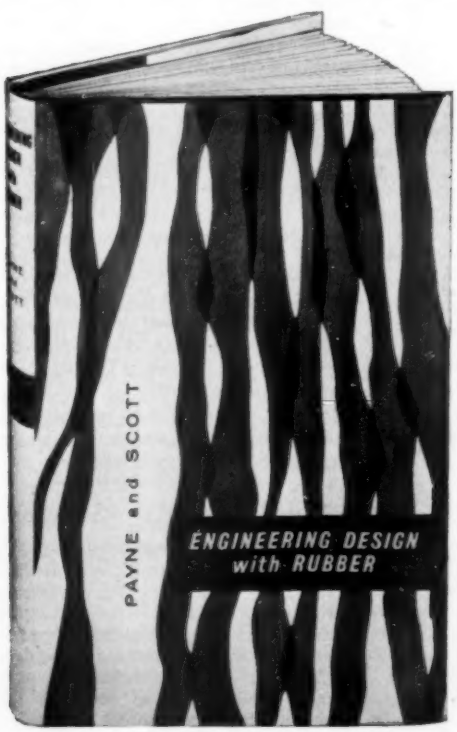

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Rubber Markets

LONDON

Renewed short covering of near Terminal positions found offers scarce; prices advanced and were upheld by firmer Singapore and New York advices. Forward positions were rather neglected. Only a small and selective demand was noted for early shipments, but the market absorbed first-hand forward cif parcels. The general quietness of the market was evidenced by the small number of contracts registered on most days.

Latest prices are as follows:
No. 1 RSS Spot: 40d. nominal.

Settlement House:
July 37⅛d.-38d.
August 36⅛d.-36⅞d.
September 35⅞d.-36⅛d.
July/September 36⅞d.-37d.
October/December 35⅛d.-35⅛d.
January/March 34d.-34⅛d.
April/June 33d.-33⅛d.

No. 1 RSS cif basis ports:
June 36⅛d.-36⅜d.
July 36⅛d.-36⅜d.

Godown:
July 124⅜ cents nominal.

LATEX

Centrifuged 60% latex per gallon in drums, seller, June 20s. 6d., July 20s. 6d., August 20s. 4d., September 20s. 2d., cif European ports, Spot, seller, 20s. 11d. Bulk, not quoted. Creamed, seller, June-July 20s. 1d. Normal or 28%, seller, June-July 16s. 6d.

DJAKARTA

Prices were generally steady on June 13. Buyers were in the minority. Sales were estimated at between 30 and 40 tons of sheet No. 1 for ready delivery at 49 to 49.50 rupiahs per kilo.

	Rupiahs per kilo June 13	Previous
Spot No. 1 Priok ..	48.50b	47.50b
Spot No. 2 Priok ..	47.50b	46.50b
Spot No. 3 Priok ..	41.50n	40.50b
No. 1 fine pale crepe, spot	44.00b	44.00b

Tone: Steadier.

AMSTERDAM

The Amsterdam rubber market ruled as under on June 13:

No. 1 RMA	Guilders per kilo June 13	Previous
June	3.56	3.56
July	3.54	3.54
August	3.53	3.53
September	3.52	3.52
July/September ..	3.53	3.53
October	3.38	3.38

Sales: 30. Tendency: Quiet.

SINGAPORE

The market opened very quiet and ruled dull throughout June 13. There was limited interest in lower sheet. Prices fluctuated narrowly in thin trading. In the afternoon, the market was relatively quiet but the turnover was fair. Main interest was in forwards. After hours, the market was slightly steadier on reports of a late China order.

	Malayan cents per lb. fob Malayan ports to open ports June 13	Previous
No. 1 RSS, June	122⅞–123⅛	123⅛–123½
July	123⅜–123½	123½–123⅞
No. 2 RSS, June	121¼–122	121½–122
No. 3 RSS, June	118 –118¾	118 –119
No. 4 RSS, June	115¾–116¼	115¾–116¼
No. 5 RSS, June	112½–113½	112 –113½
No. 1 RSS, Spot	122⅞–123½	123⅛–123⅞
No. 3 blanket thick remilled crepe, June	112½–113½	112 –114
No. 1 fine pale crepe, June ..	128½–129½	128½–130½
2X thin brown crepe, June ..	111½–112½	111 –112

Tone: Slightly steadier.

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums fob at 232.40d. per gallon.

NEW YORK

The New York rubber market ruled as under on June 13:

DEALERS' PRICES

	US cents per lb. Ex-dock June 13	Previous
No. 1 RSS, June ..	45n	44⅛a
July ..	43⅛n	43a
No. 2 RSS, June ..	44⅞n	44⅜a
July ..	43⅜n	42⅞a
No. 3 RSS, June ..	44⅜n	44⅛a
July ..	43⅛n	42⅞a
No. 1 RSS, Spot ..	45n	44⅛n
No. 3 amber blanket crepe, August ..	39⅞a	39⅞n
No. 1 latex thin crepe, June	44⅞n	44⅜n
No. 1 latex thick crepe, June ..	44⅞n	44⅜n

FUTURES—REX CONTRACT

	Close	Prev. Close
July ..	43.65t	43.10b—43.30a
Sept. ..	41.40t	41.10t
Nov. ..	40.25t	40.10t
Jan. ..	39.60b—39.85a	39.25b—39.35a
March ..	39.15b—39.25a	38.70b—38.90a
May ..	38.35b—38.50a	38.25b—38.50a
July ..	37.90b—38.20a	37.80b—38.20a

Sales: 10. Tone: Steady.

Rubber futures were steady on June 13 in meagre trading. Physical rubber was steady but also quiet. In late dealings, futures were moderately higher but trading continued slight.

BANGKOK

No. 1 RSS

The price of No. 1 RSS at Bangkok on June 13 was 38.75 (38.75) US cents per lb.

CEYLON

No. 1 RSS

The price of No. 1 RSS at Colombo on June 13 was 144 (144½) Ceylon cents per lb.

STOCK MARKET

Continued from page 948

tiations were in progress and should these come to fruition a further announcement would be made immediately.

Meantime, they decided to increase the interim dividend from an equal 3¾% to 6%. The directors said that the progress reported last February has been more than maintained. For the first seven months of the current year turnover has increased by around 18%. This had resulted in an increase in pre-tax profits of over 55%. The order position for all the group's companies was satisfactory and it is anticipated that trading for the last five months will continue at the current level.

AULT AND WIBORG announced a 5% increase in its dividend to 25%. The company's profits have gone up from £687,900 to £824,400 before tax of £373,600 against a previous £321,200. In our price list the company's shares show a 1s. 9d. rise to 24s. 9d. after having touched a new 'high' for the year of 25s.

LAPORTE INDUSTRIES was yet another company which had good news for shareholders. Group trading profits in this instance have expanded to £4,334,700 from £2,860,200 and dividend from an equal 6¾% to a total equivalent of 10%.

Sprite Uses Neoprene

Neoprene sparking plug covers were used in the record-breaking Austin-Healey Sprite for speed endurance trials carried out on Utah Salt Flats. Other neoprene parts included the brake hose covers, ignition wire, tie rod seals, steering rack bellows and steering column draught excluder.

The sprite covered 1,665 miles at an average speed of 139mph.

Honour for Loudon

Jonkheer J. H. Loudon, president of the Royal Dutch Petroleum Company and senior managing director of the Royal Dutch/Shell Group, has been made an Honorary Knight Commander of the Order of the British Empire, in recognition of his contributions to the national economy and to British interests abroad.

Reichhold Rights Issue

At the annual general meeting held on June 14, the chairman of Reichhold Chemicals Ltd., Mr W. H. Breuer, announced that in view of the capital expenditure programme the directors have decided to make forthwith a rights issue of one for four on terms to be arranged. The profits of the group in the first quarter of the current year exceed those for the comparable period of 1959.

Industry INTELLIGENCE

Technical Data

Alkyl Morpholines

Robinson Brothers Ltd., Ryders Green, West Bromwich, have issued two technical bulletins dealing with the properties and uses of N-methyl morpholine and N-ethyl morpholine, both of which are currently in production by the company. Both behave chemically as aliphatic tertiary amines, are unstable to oxidizing agents and give quaternary salts with alkyl halides.

The main use of both compounds is as a catalyst in the production of polyurethane foams, particularly one-shot polyether types, and other applications include the separation of styrene from other hydrocarbons and the preparation of penicillin.

Reomol Plasticizers

Technical Data sheet No. 17, issued by The Geigy Company Ltd., Rhodes, Middleton, Manchester, concerns two modifying plasticizers Reomol MN and Reomol MI (formerly Reomol DV3 and Reomol DV12) intended for use with phosphate and phthalate type plasticizers. They improve low temperature properties and are useful in reducing the viscosity of TXP plasticized PVC pastes. Tables are given comparing the properties of compounds containing Reomol MN and MI with compounds containing TXP and Reomol D79P, and of compounds plasticized with combinations of these materials. Particulars are given of the advantages obtained in processing and compounding of PVC pastes by using 50/50 mixtures of MN/TXP, or MI/TXP, this giving a much lower viscosity than would be expected from viscosity measurements on the plasticizers themselves.

Polysar Copolymers

Polysar Krynac XPRD-794 is a copolymer of butadiene and acrylonitrile, combines easy processing characteristics with good oil resistance, and is recommended for applications requiring maximum oil resistance where no plasticizer can be tolerated, or where a high filler loading at a low plasticizer level must be used. The material has a non-staining stabilizer, a Mooney viscosity of 47 (ML4 at 212°F), and contains 38.5% of acrylonitrile.

Polysar Latex 722, which is a styrene-butadiene type, is of especial interest as a carpet backing when used in compounds with a high filler loading. It gives backings which are tough and flexible, have excellent resistance to moisture or dampness, are compatible with synthetic fibres, and can contain up to 400 parts of whiting per 100 parts latex solids.

Polysar Krynac 803 - PVC compounds have excellent oil, fuel and ozone resistance, and can be compounded to give good flame resistance. Because of these properties compounds of this type have been widely used in such products as cable jackets, oil resistant footwear, belting, hose and tubing. Originally it was found necessary to flux the resin during mixing of nitrile rubber-PVC blends, involving high temperatures difficult to obtain with some equipment. Later results, however, show that, providing the temperature at some stage during the process reaches the fluxing temperature of the resin, lower mixing temperatures may be used.

Details of the effect of mixing temperatures on blends of PVC with Polysar Krynac 803 are given in Technical Report No. 9:4B and on the use of Latex 722 in No. 9:4C. These reports are distributed in this country by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Polyurethane Foam Insulation

The insulation of pipes with preformed sections of polyurethane foam, made from Daltolac 41 and Suprasec D, is considered in Technical Information sheet Urethane PC/U.16 issued by the Polymer and Chemicals Service Department, Dyestuffs Division, Imperial Chemical Industries Ltd.

Notes are given on the materials used, handling precautions and storage conditions, a description of the foam dispensing unit, moulds and mould release agents. Diagrams of typical moulds show the method and materials used in their construction, and comprehensive details of the preparation, erection and properties of pipe sections are listed.

Machines, Materials and Equipment

Sealed Voltage Converter

By the use of semi-conductor devices it is possible to convert battery voltages of, say, 6, 12, or 24 volts to higher AC or DC voltages without the disadvantages of noise or mechanical weakness inherent in conventional vibratory or rotating converters.

A semi-conductor unit has no moving parts and can be designed to have a long life with no need for any sort of maintenance. It can be small, light and of high electrical efficiency.

A range of converters taking advantage of these features has been produced in the form of compact units hermetically sealed in metal cans. These are said to be particularly suitable for transportable equipment and will withstand tropical conditions.

Folding Truck

Time and motion study shows that, in many factories, it is convenient to have a light truck which will carry a single sack, and yet be small enough to be stored away in a small space when not needed.

A lightweight truck to meet this requirement is constructed of ¾in. tube and weighs about 12lb. It has a carrying capacity of 1¼cwt., but when not in use folds up compactly into a very small unit.

New Publications

Ultramid

BASF have published a new booklet describing their nylon resin, Ultramid. This product is particularly suitable for mechanical components, containers, combs, shoe heels, slide fasteners and for a wide variety of other applications where considerable mechanical stress is involved.

The new booklet is attractively written and printed in colour and contains numerous graphs and tables illustrating the properties of Ultramid. Information is given concerning the potential applications of the product while reference is also made to methods of fabrication. The new publication should be of particular interest not only to plastics processers but also to those concerned with the design of plastic components.

Air-drying Acrylic Copolymer Solutions for Car Finishes

Vinalaks R2880 and R2881 are development products specially produced for the manufacture of car finishes of excellent colour and gloss retention under conditions of intense sunlight and high humidity. These products are solutions of acrylic copolymer resins in toluene, and information on their properties and use in finishes is given in a leaflet issued by Vinyl Products Ltd., Butter Hill, Carshalton, Surrey.

R2880 and R2881 have been designed to give maximum petrol resistance, good pigment dispersing properties and excellent gloss when applied by a spray gun. These resins do not normally need the addition of plasticizers but they can be modified with all normal ester plasticizers if increased film softness is desired. R2880 and R2881 can be diluted with all normal lacquer solvents, data being given for the viscosity of a typical sample when diluted with various solvents. A formula is included in the leaflet for a pigmented finish containing a blend of R2880 and R2881. This finish was exposed for 12 months in Florida, USA, and was found to be greatly superior in gloss retention to a commercial nitrocellulose finish.

British Standards

Toughened Polystyrene

This new British Standard specifies the basic requirements for toughened polystyrene in the form of granules for sheet extrusion, consisting of thermoplastic polymers or copolymers of styrene and suitable additives. It provides basic data for the control of quality of the material, rather than information on the properties of extruded sheet.

Requirements for physical properties are followed by five appendices relating to methods of testing; and by a full-page diagram showing the dimensions of a mould.

Testing Vulcanized Rubber

BS 903. Methods of Testing Vulcanized Rubber; Part A13: 1960. Determination of Resistance to Low Temperatures (Rigidity Modulus Test). Part A13 replaces Part 23 of the 1950 edition and apart from an alteration in the title the main difference lies in the layout, the order of the sections having been altered slightly. A rather more comprehensive description of the various types of apparatus which may be used is given, together with details of the procedure to be followed and the method of expressing results. There are three full page diagrams.

Rubber Gloves for Electrical Purposes

This revised publication (BS 697) specifies requirements for gloves for use at four different voltage potentials: up to 650, 1,100, 3,300 and 4,000 volts. The gloves may be made by dipping, moulding, or built-up from sheet rubber.

A feature of the revision is that each glove is now required to be tested twice by the manufacturer for its voltage withstand. The second test has been introduced to seek out those gloves which have a tendency to pick up excess moisture, which reduces dielectric strength. Research work into this phenomenon has been carried out by the Electrical Research Association, who have taken an active part in the redrafting of the standard.

The address of the British Standards Institution Sales Branch is 2 Park Street, London, W.1

What is claimed to be a speedy new process for forming and decorating outdoor signs has been developed in America by Eastman Chemical Products. This uses new laminated butyrate sheet which is continuously extruded in two different coloured layers. It is decorated, after vacuum forming, by sanding off the upper layer to permit the lower layer to show through in a raised design or lettering.

PLASTIC FOIL VACUUM COVERING

A step forward in the development of plastics is marked by the introduction of the vacuum-covering process for radio cabinets. Using this process, a new I.C.I. product—'Novon' 504—has been successfully vacuum-formed over cabinets hitherto covered in leathercloth by hand. This new method is said to be cheaper and faster.

'Novon' 504 is a thermoplastic foil introduced by I.C.I. (Hyde) Ltd., a subsidiary company of Imperial Chemical Industries Ltd. It is the result of two years of research on polymers, plasticizers, stabilizers and adhesives, to produce a foil which would stand up to the severest anticipated conditions of application and end-use. To assist in speeding up the covering process, 'Novon' 504 can be supplied already coated with a suitable adhesive to radio cabinet manufacturers.

Retains Texture

In the vacuum-covering process, working temperatures in excess of 120°C. are normal, and radio cabinets are often subjected to high temperatures in window displays. Such conditions do not impair the properties of this specialized foil, which retains its original surface texture when it has been secured to the cabinet. Available in a range of attractive colours, 'Novon' 504 has a highly abrasion-resistant finish.

Three manufacturers of radio cabinets have already introduced radio sets covered with 'Novon' 504. They are Murphy Radio Ltd., J. and A. Margolin Ltd., and Pilot Radio and Television Ltd. Manufacturers outside the radio industry are now experimenting with vacuum-covering, and suppliers of vacuum-forming equipment report increased interest in this new technique.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

VENUS (791,836) Wrapping and packaging materials made of plastics; and boxes and cartons, all made of cardboard. Venus Packaging Ltd., Lower Middleton Street, Ilkeston, Derbyshire. (Class 16; March 29 1960).

TIGER (785,764) Plastics in the form of sheets, blocks, rods, tubes and shaped sections, being for use in manufactures; and articles made from such plastics, from india-rubber, balata or from gutta-percha, all included in Class 17. Shum Yip Leong, trading as Shum Yip Leong Rubber Works, 1¼ Mile, Kapar Road, Klang, Federation of Malaya. Address for service is c/o Carpmaels and Ransford, 24 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 16; March 29 1960).

FABLONEX (798,231 and 798,233) Laminations of synthetic resin plastics in sheet form prepared for use in the construction, or decoration of buildings and of the like civil engineering constructions. Commercial Plastics Ltd., Willington Quay, Wallsend - on - Tyne, Northumberland. (Classes 19 and 27; March 29 1960).

EXPOL (794,507) Packing, packaging, padding and stuffing materials of rubber or of imitation rubber made of plastics; and insulating materials and articles, all included in Class 17. Export Packing Service Ltd., Wellwinch Road, Sittingbourne, Kent. (Class 17; March 29 1960).

PANDA BOARD

(792,835). Fibreboard, chipboard, particleboard, blockboard, laminated board, composition board and boards faced with plastics, wood-based material in sheet form and laminated blocks, none of the aforesaid goods being wholly or principally of metal; and manufactured timber. Oy Wilh. Schauman AB., Jyvaskyla, Finland. Address for service is c/o Haseltine, Lake and Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 19; March 29 1960).

WANALITE (793,930) Hardboard faced with laminates of plastic. Harald Wallander, Sven Harald Wallander and Bengt Adolf Wallander, trading as Bröderna H. Wallander, Nordmaling, Sweden. Address for service is c/o Churchill and Sim Ltd., 29-31 Clements Lane, London, E.C.4. (Class 19; March 29 1960).

MYROPERL (795,863). Imitation mother of pearl and articles thereof included in Class 20. Arranite Plastics Ltd., Arranite Mills, Factory Lane, Harpurhey, Manchester 9. (Class 19; March 29 1960).

Quarter - size scale model of an Austin A55 Mark 2 saloon made from Araldite epoxy resin and glasscloth. It is used by Austin to check the general appearance, style and colour scheme of the car before starting production

NEW COMPANIES

Export Tyre and Rubber Co. Ltd. (657,638).—April 28. Capital: £100 in £1 shares. The directors are: Robert Leigh, 17 St. Thomas Road, N.14; and William J. T. Osborne, 182 Maldon Road, Tiptree, Essex. Reg. office: 13/14 New Bond Street, W.1.

Rubber Estate Agency Investments Ltd. (657,156).—April 22. Capital: £100 in £1 shares. The directors are: Harold F. Copeman, James W. A. Calver and Gordon Douglas, all of 53 Eastcheap, E.C.3. Reg. office: 53 Eastcheap, E.C.3.

J. A. Norris (The Rubber Man) Ltd. (657,291).—April 25. Capital: £12,000 in £1 shares. To acquire the business of a rubber merchant outfitter, etc., now carried on by John A. Norris, at 62 Pasture Street, Grimsby, as "J. A. Norris, The Rubber Man." The directors are: John Albert Norris (permanent), 17 Humberston Avenue, Humberston, Grimsby; John Austin Norris, 11 Peaks Lane, New Waltham, Grimsby; Edith May A. Norris, 17 Humberston Avenue, Humberston; and Edwin Fletcher, 176 Grimsby Road, Humberston. Reg. office: 62 Pasture Street, Grimsby, Lincs.

Southern Plastics and Mouldings (Portsmouth) Ltd. (658,756).—May 10. Capital: £100 in £1 shares. To carry on the business of plastic moulding and all other processes in connection with plastic and other materials, etc. The permanent directors are: William F. Coles, 7 Clarence Parade, Southsea; Arthur E. L. Elliott, 20 Priory Crescent, Southsea. Regd. office: 30/32 Forbury Road, Portsmouth, Hants.

P.M. Tools Ltd. (658,842).—May 11. Capital: £10,000 in £1 shares. To carry on the business of manufacturers of and dealers in engineering and plastic products, etc. The directors are: Robert Warans, 24a St. Bernards Road, Slough, Bucks.; Cyril J. Evans, 13 Derwent Drive, Priory Estate, Slough, Bucks.; William T. Picton, 19 Thorndike, Britwell Estate, Slough, Bucks. Regd. office: 657 Ajan Avenue, Slough, Bucks.

Willmott and Weston Ltd. (658,869).—May 11. Capital: £100 in £1 shares. To carry on the business of manufacturers of fittings, furniture and articles of plastic, etc. The directors are: Brian S. Willmott, 50 Lamerton Road, Reading; Brian A. W. Weston, 13 Argyle Street, Reading; Archibald W. Moss, Quarry House, Kentwood Hill, Tilehurst, Reading. Regd. office: 20 Norcot Road, Tilehurst, Reading.

Tyre Services (Glasgow) Ltd. (658,808).—May 10. Capital: £100 in £1 shares. To carry on the business of manufacturing, retreading, remoulding, repairing, buying, selling, and dealing in rubber tyres, tubes and belts, etc. The directors are: John Blacklock, 58 Scotby Road, Scotby, Carlisle; Mrs Winifred Blacklock, 58 Scotby Road, Scotby, Carlisle. Regd. office: Durranhill Industrial Estate, Carlisle.

Western Plastics Ltd. (658,590).—May 9. Capital: £100 in £1 shares. The directors are: William J. Horlock, 135 Pennywell Road, Bristol; Leslie Macey, 33 Sabrina Way, Stoke Bishop, Bristol; Michael D. Smith and Paul S. Smith. Regd. office: 19 Nelson Parade, Bedminster, Bristol, 3.

Fi-Glass Ltd. (657,003).—April 21. Capital: £500 in £1 shares. To carry on the business of manufacturers and merchants of and dealers in glass fibre, glass reinforced plastic and plastic moulded processes, boats, fuel tanks, motor cycle fairings, etc. The directors are: Richard T. Jupp (permanent) and Mrs Margaret A. Jupp, both of 277 Crofton Road, Orpington, Kent. Regd. office: 277 Crofton Road, Orpington, Kent.

Harrison and Jones (Flexible Foam) Ltd. (654,678).—March 30. Capital: £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in synthetic materials of fabrics, fibrous and textile substances, plastic polythene, bakelite and rubber products, etc. The directors are: William M. Black, 'Holbeck,' Merrilocks Road, Blundellsands, Liverpool, 23, and Louise M. Garrett, 'Rockgarth,' Score Lane, Liverpool, 15. Regd. office: Purax Mills, Vauxhall Road, Liverpool, 5.

Shannon Tyre Service (Reading), Ltd. (658,533).—May 6. Capital: £1,000 in £1 shares. The directors are: Mrs Phoebe Dunstan, Lime Tree House, Chatham Street, Reading, and Clifford S. Coram, 17 Howard Road, Wokingham, Berks. Regd. office: 44 Orts Road, Reading.

Apollo Display Services Ltd. (658,194).—May 4. Capital: £1,000 in £1 shares. To acquire the business of plastic displays manufacturers carried on at Hull as Plastic Displays, etc. The directors are: Peter Barden, 88 Penshurst Avenue, Hessle, E. Yorks.; James Myers, 'Kaplevin,' Tranby Park, Hessle, E. Yorks. Regd. Office: 20 Nile Street, Hull.

Dorset Plastics Company Ltd. (658,679).—May 10. Capital: £500 in £1 shares. To carry on the business of manufacturers and fixers of and dealers in laminated plastics, etc. The directors are: Angus N. Tombs, 21 Canford Cliffs Avenue, Parkstone, Dorset, and Brian R. Crocker, 73 Corhampton Road, Boscombe East, Bournemouth. Regd. office: 14 Denmark Lane, Poole, Dorset.

Fibrofin Ltd. (658,610).—May 9. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in glass fibre, etc. Zbigniew Dutczynski (otherwise known as Vernon Dutch) is the first director. Regd. office: 81A Gloucester Road, S.W.7.

Changes of Name

Plastic Materials (Midlands) Ltd. (435,328), 3 Red Place, Grosvenor Square, W.1. Name changed to Logard Property Co. Ltd., on December 1 1959.

Kleeman Plastics Ltd. (595,828), 17 Winchester Road, N.W.3. Name changed to Kleeware Plastics Ltd., on December 1 1959.

Stebar Ltd. (632,333). Manufacturers of and dealers in plastics and synthetic resins, etc., 18 Austin Friars, E.C.2. Name changed to Barford and Stevens Ltd., on November 26 1959.

COUNTY COURT JUDGMENTS

NOTE.—These Judgments which are supplied from the Registry of County Court Judgments, Lord Chancellor's Department, 3 Dean's Yard, London, S.W.1, are not necessarily for debt, and some may have since been satisfied. They may be for damages or otherwise, they may relate to actions bona fide contested between the parties, or they may be against defendants liable in a representative capacity and not personally; but no distinction is made on the register. A judgment does not imply inability to pay. Judgments are not returned to the Registry if satisfied in Court Books within twenty-one days.

HENRY DANIEL MASTER, 25 Charlton Place, London, N.1., tyre dealer. Shoreditch, £12 1s. 6d., January 27 1960.

POLYPLAK (CONTAINERS) LTD., 165 Railway Arches, Stamford Brook, W.6, London. West London, £16, February 5 1960.

FOAMPLAST PRODUCTS LTD., 92 Goldstone Villas, Hove, Sussex. Brighton, £19 3s. 9d., January 6 1960.

RYLAX LTD., Hallgate, Cottingham, Yorks., latex foam specialists. Skipton, £10 3s. 3d., January 13, 1960.

GEORGE BIRD, 18a Well Lane, Batley, Yorks. Kingston, Hull. £76. February 2 1960.

L. M. PLASTICS, 4 Regent Street, Leamington Spa, Warwicks. Warwick. £47. February 10 1960.

C. H. STEWART, 3 Clipstone Street, West Bowling, Bradford 5, Yorks., scrap rubber merchant. Bradford. £23. February 19 1960.

Latest Wills

Mr. Edgar Ronald Crammond, of Star House, East Blatchington, Sussex, late chairman of British Industrial Plastics Ltd., etc., who died on January 25 last, left £79,767 gross, £72,160 net value.

Mr. James Douglas Falconer, of 20 Dalby Road, Melton Mowbray, Leics., formerly of Erracht Estate, Dehiowita, Kegalle, Ceylon, retired rubber planter, who died on October 31 last, left estate in Great Britain valued at £12,897 gross, £12,769 net value.

Mr. Frank Duxbury, of Brackendene, Maple Walk, Cooden, Sussex, late a director of Chersonese (F.M.S.) Estates Ltd., and Kong Lee (Perak) Plantations Ltd., who died on February 19 last, left £242,109 gross, £239,580 net value.

Mr Thomas George Sumner, of 110 Antrobus Road, Wylde Green, Sutton Coldfield, Warwickshire, district manager for the Dunlop Rubber Co. Ltd., who died on January 29 last, left £5,491 gross, £5313 net value.

Mr. Charles Walter Goff, of 27 Woburn Square, W.C.1, member of the London Stock Exchange, late chairman of Sungei Kari (Sumatra) Rubber Estate Ltd., and chairman of Eileen Alannah Mining Co. Ltd., who died on December 21 last, left £59,718 gross, £59,346 net value. (Duty paid £30,882.).

R·I·P·

CLASSIFIED ADVERTISEMENTS

APPOINTMENTS VACANT

6d. a word, Minimum 10/- Box 2/-

DESIGN draughtsman required by engineers manufacturing paper converting machines and hydraulic rubber and plastic presses. Applicants should have sound mechanical experience and/or hydraulic knowledge. Pension scheme in operation.—T. H. Dixon and Co. Ltd., Letchworth, Herts. (324)

ESTIMATING. A manager for the estimating department of a London rubber manufacturers is required. Experience in general rubber goods and a qualification in costs and works accountancy are desirable. The salary will be commensurate with experience and qualifications. Superannuation facilities exist and this years holiday commitments will be honoured.—Apply with full details to Box 342. (342)

APPOINTMENTS VACANT

(continued)

PRODUCTION technologist for plastic sheeting, plastic coating and kindred applications. Knowledge of plastics essential. Experience with calenders and spreading techniques desirable. Medium-sized progressive company in the North of England. An opportunity for a man of ideas and a thorough knowledge of technical works practice. The appointment carries a substantial salary and is pensionable.—Box 332. (332)

REQUIRED rubber and plastics calender charge hand for 68in. 3-bowl modern calender. Must be fully experienced in frictioning heavy canvas materials and sheeting both rubber and plastic. High rate paid to first-class operator. Write giving full details of experience. Position is in South London area.—Box 321. (321)

APPOINTMENTS VACANT
(continued)

RUBBER TECHNOLOGIST

Well-established company based on Manchester and supplying materials to the rubber manufacturing industry invites applications from technologists with qualifications which would enable them to take charge of the sales service section of their laboratories.

A.I.R.I. standard or chemical qualifications supported by suitable experience in the rubber industry.

Applications, which will be treated in strict confidence, should give details of age, education, technical standard and experience.—Box 340. (340)

AN adhesives technologist is invited to play an important part in the extension, throughout the world, of our technical service. The company manufactures synthetic thermoplastic resins and is situated in the London area. There is a pension and life assurance scheme in operation.—Applications may be addressed to Box 343. (343)

CHINA clay laboratory requires a chemist who is prepared to work on own initiative. He must be able to control quality and to develop research on raw material. The company's offices are situated in most pleasant surroundings and quite near to the coast. An unfurnished flat is available to the successful applicant. Salary in the region of £700-£800 according to qualifications. Pension scheme.—Applications in strict confidence, with full details of qualifications and experience to The Secretary, The New Consolidated Mines of Cornwall, Ltd., Fairmead House, Palace Road, St. Austell, Cornwall. (339)

SENIOR RUBBER TECHNOLOGISTS

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Candidates will probably be aged 27 to 40, with A.I.R.I. and/or A.P.I., A.R.I.C., B.Sc., etc., also some experience in one or more of the following fields:—

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Such men, who consider themselves worthy of excellent prospects with a commencing salary in region of £1,200 p.a. should send full education and career details to Box 295. (295)

APPOINTMENTS VACANT
(continued)

RUBBER technologist required by company specializing in continuous-vulcanization of floorings. Preferably in age group 22-28, and to at least L.I.R.I. standard. Required to work mainly on development and control of rubber and synthetic floorings. Staff pension scheme. Works pleasantly situated in North-West Middlesex.—Box 328. (328)

SALES manager required, firm North-West England. Practical knowledge of plastic manufacture, calendering and spreading desirable. Salary £1,800-£2,000, plus car, plus expenses. This appointment is pensionable, offers tremendous scope to applicants who possess initiative and originality.—Box 333. (333)

SALES technologist required for plastic sheeting by a company producing coated textiles by calendering and spreading processes. Must be thoroughly experienced in this field and have ability for customer liaison and sales development. Adequate salary and pension scheme.—Box 331. (331)

APPOINTMENTS WANTED

6d. a word, Minimum 10/-. Box 2/-.

EXECUTIVE, educated at top public school, and having many years' experience in the rubber industry seeks appointment. Late chief chemist and thoroughly conversant with modern compounding techniques for commercial and Government specifications. Salary required, London area £1,250 per annum, elsewhere £1,500 per annum.—Box 345. (345)

BUSINESS PROPOSITIONS

6d. a word, Minimum £1. Box 2/-.

NORTH-WEST engineers (public company) wishes to contact small/medium-sized rubber manufacturers with a view to acquiring control.—The Secretary, Box 337. (337)

MACHINERY FOR SALE

6d. a word, Minimum 12/6. Box 2/-.

BLACKFRIARS 24 x 12 rotary cutter with 20 h.p. motor and starter. One complete set of spare knives, together with pneumatic take-off equipment, vibratory screen and steel staging. The above comprehensive equipment is in excellent condition and is available immediately. Price complete £800. Ex works.—Box 327. (327)

BRIDGE Banbury No. 11 with 250 h.p. drive. Bridge 84in. x 26in. mill with 150 h.p. drive. Bridge 10in. strainer with 175 h.p. drive. All in excellent condition, available for immediate delivery.—Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Tel.: Woolwich 7611 (6 lines). (330)

B.U.S.M. clicking or cutting press for leather, rubber, plastics, card, fibre board, etc., for sale. Bed 36in. x 17½in. max. daylight 7in. Swing ram face 11in. x 20in. Cutting board. Photos, etc.—F. J. Edwards Ltd., 359 Euston Road, London, N.W.1. (338)

'COTSWOLD' dipping machines and circulating tanks for latex and PVC. New catalogues now available on request.—Lionel Hook and Sons, Ebley, Stroud, Glos. Tel.: Stonehouse 614/5. (380R)

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MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

STEAM-HEATED rubber vulcanizing oven, 4ft. dia. x 6ft. long, in first-class condition.—Box 335. (335)

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Applications, which will be treated in strict confidence, should give full details of age, education, professional/technical qualifications and experience.—Box 329. (329)

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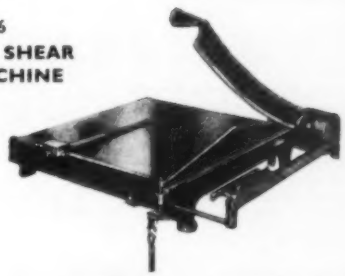

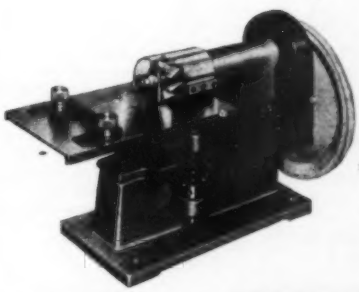

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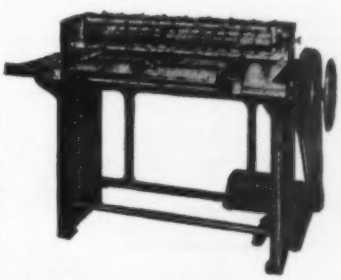

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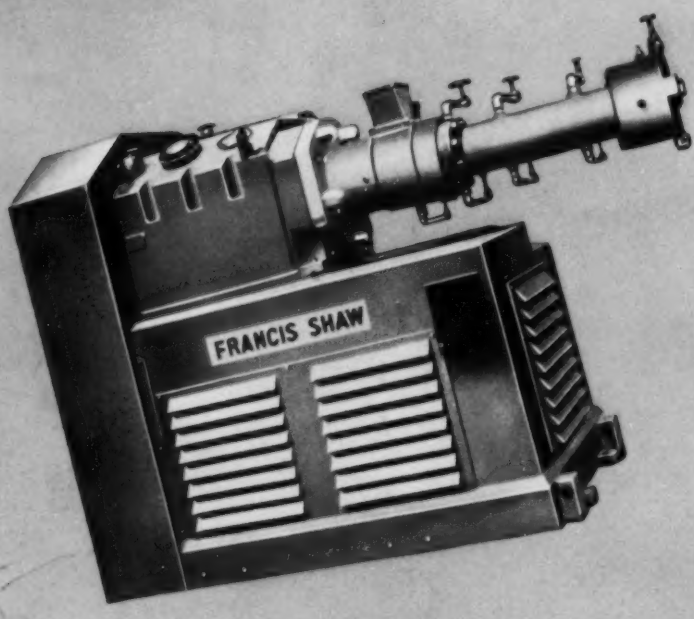

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